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## FRAGER'S WATER METER.

In 1872, M. Frager introduced to the notice of water-supply companies a new water meter, which was very favorably received, and which from that time to the present has been extensively used by the companies supplying water to various of the larger towns and cities of France. Recently the inventor has greatly modified the construction of the apparatus, so that it is exceedingly simple, moderate in price, and is not influenced in its correct working by variations in pressure. The operation of this meter, which is shown in the annexed cuts, is as follows:

The water enters the meter through the inlet pipe, which empties at the top of the distributing box. It traverses a sieve, which serves to remove the larger impurities, and exerts its pressure against the slide valves, T and T'. This pressure is transmitted to the measuring cylinders, $C_1$ and $C_4$, from the cylinders, $C_2$ and $C_3$, through the orifices, $O_1$ and $O_4$, which stand open. Since, at the same instant, the orifices, $O_2$ and $O_3$, are in communication with the outlet pipe through the intermedium of the ports of the slide valves which cover them, the spaces, $C_2$ and $C_3$, are in a state of discharge, and the pistons, P and P', which separate these chambers from the first, tend to displace themselves toward the left. The piston, P', abutting against the end to the left, by the extremity of its rod, remains immovable; but P moves forward toward this same end, and, striking against it, admits a cylinderful of water into $C_1$, at the same time expelling a like quantity of water from $C_3$. Before reaching the limit of its travel, it displaces the slide valve, T', which uncovers the orifice, $O_3$, and covers up the orifice, $O_4$. As a consequence of these displacements the pressures are reversed in the cylinder, $C_1$; $C_2$ is charged; $C_4$ is discharged; and the piston, P, shoved toward the right end, drives a second cylinderful of water into the discharge pipe. Before stopping at the end of its travel, it displaces the slide valve, T', which uncovers $O_3$ and covers $O_1$. Owing to this displacement, the pressures are reversed in the cylinder, $C_1$, and $C_3$ is charged, while $C_1$ is emptied. The piston, P, moves toward the right, driving a third cylinderful of water into the discharge pipe, displacing, on arrival at the end of its travel, the valve, T, and thus causing the expulsion of a fourth cylinderful of water by the piston, P'.

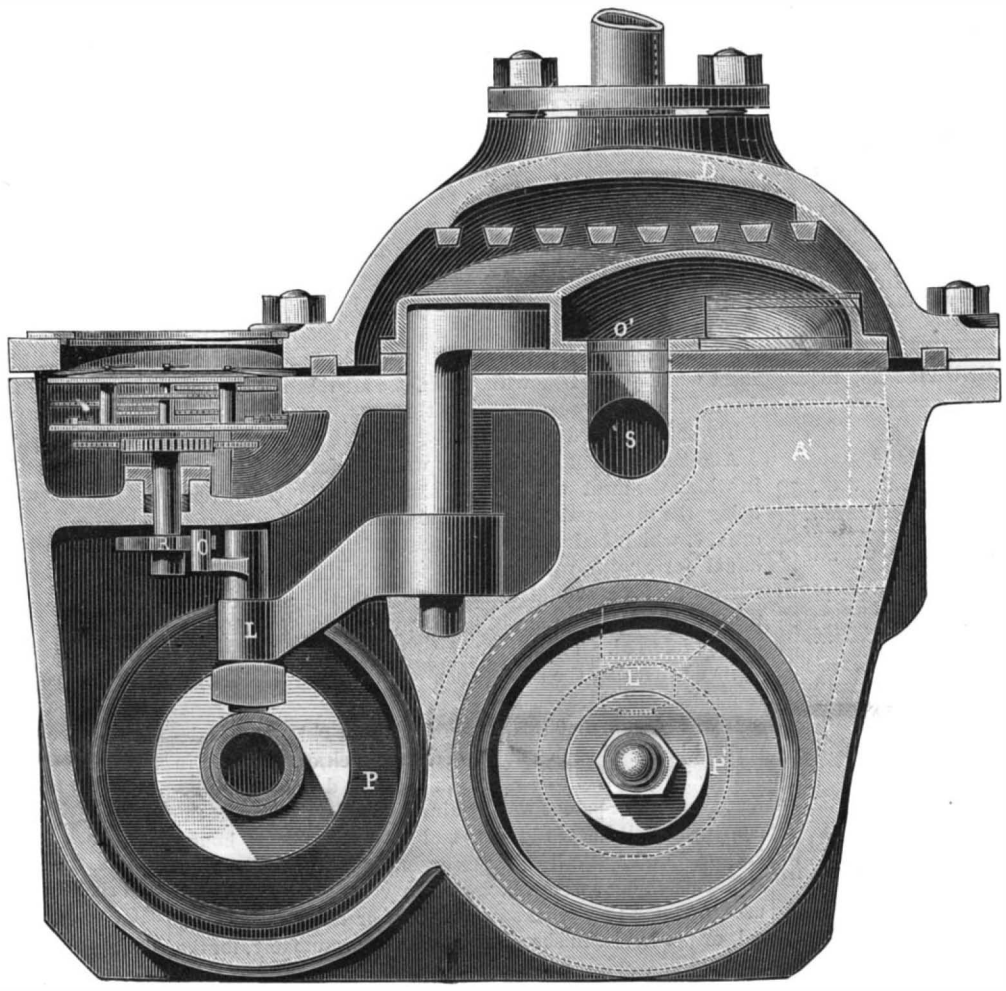


Fig. 1.—VERTICAL SECTION.

The different parts of the mechanism have now returned to their starting point, except the ratchet wheel, R, which has moved forward but one tooth, while the apparatus has been distributing the four cylinderfuls of water. This ratchet wheel actuates the clockwork which registers the quantity of water that passes through the meter. The movements just described take place as long as the inlet cock remains open.

It only remains to add a few complementary details.

Each piston, toward the end of its travel, actuates the valve which distributes the water into the other cylinder. To effect this the piston rod carries two cams, $H_1$ and $H_3$, or $H_2$ and $H_4$, which alternately act on the friction roller at the lower extremity of the controlling lever, L or L'; the latter moving on the axle, A or A'. The eccentric head of this axle is situated under the port of the slide valve (in a compartment separated from the one which operates to distribute the water) in such a manner that it pushes along the valve and carries it around the axle, now over the right orifice, and then over the left one. The mechanism which transmits motion to the clockwork is

[*Continued on page* 114.]

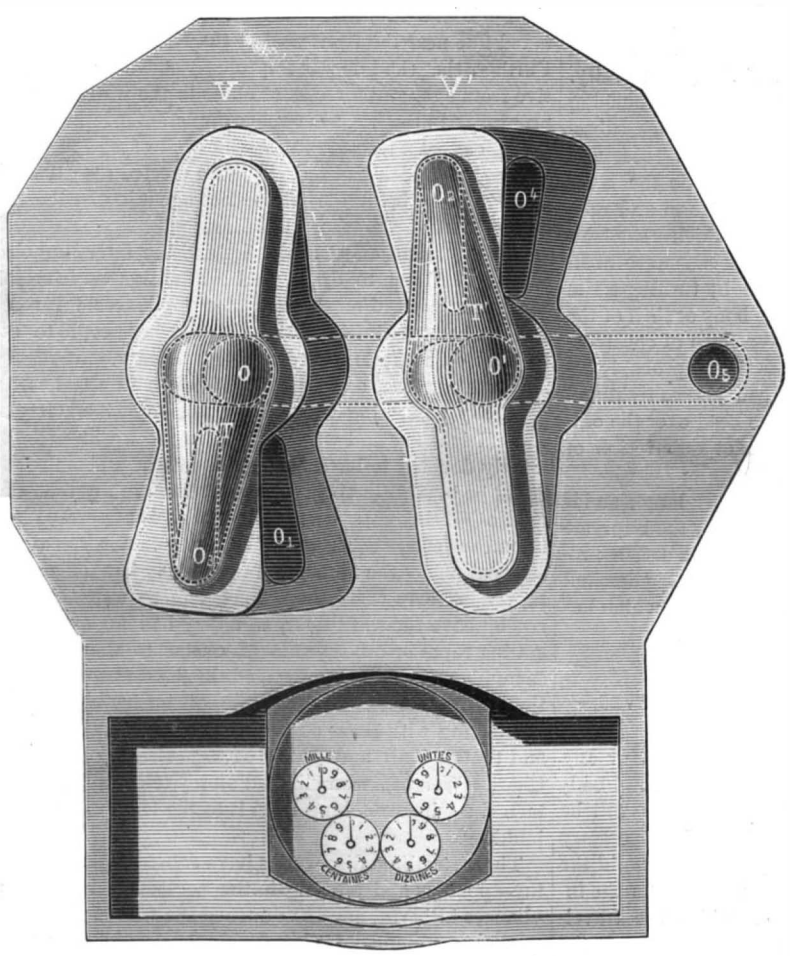


Fig. 2.—PLAN OF THE APPARATUS.—THE DOME REMOVED TO SHOW DISTRIBUTION.

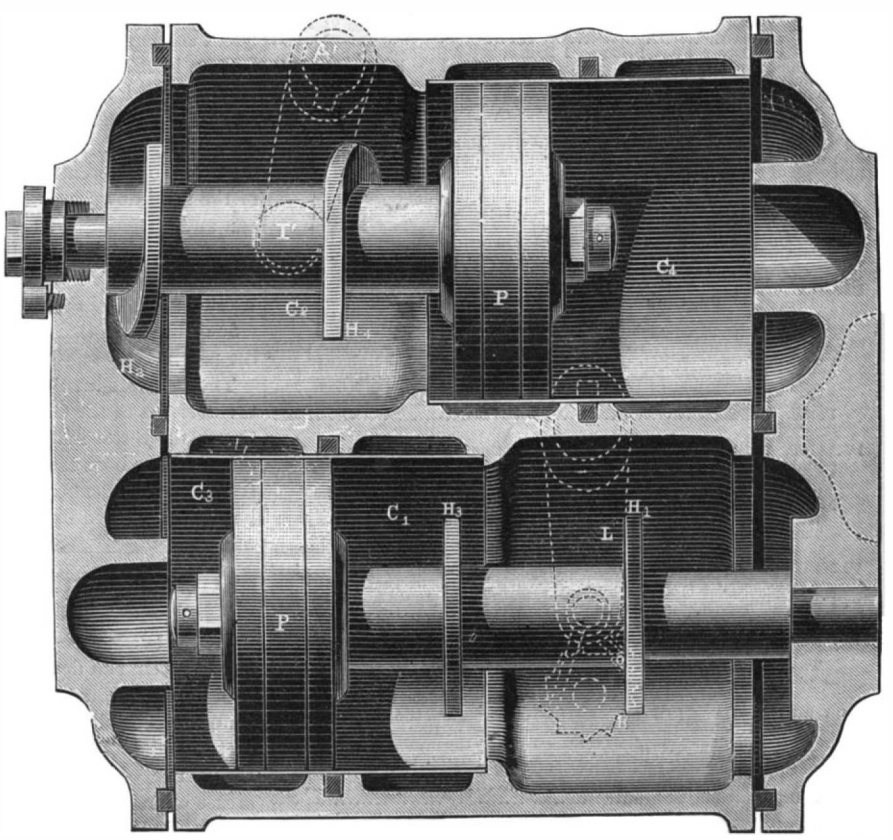


Fig. 3.—HORIZONTAL SECTION THROUGH THE AXIS OF THE PISTONS.

**FRAGER'S WATER METER.**

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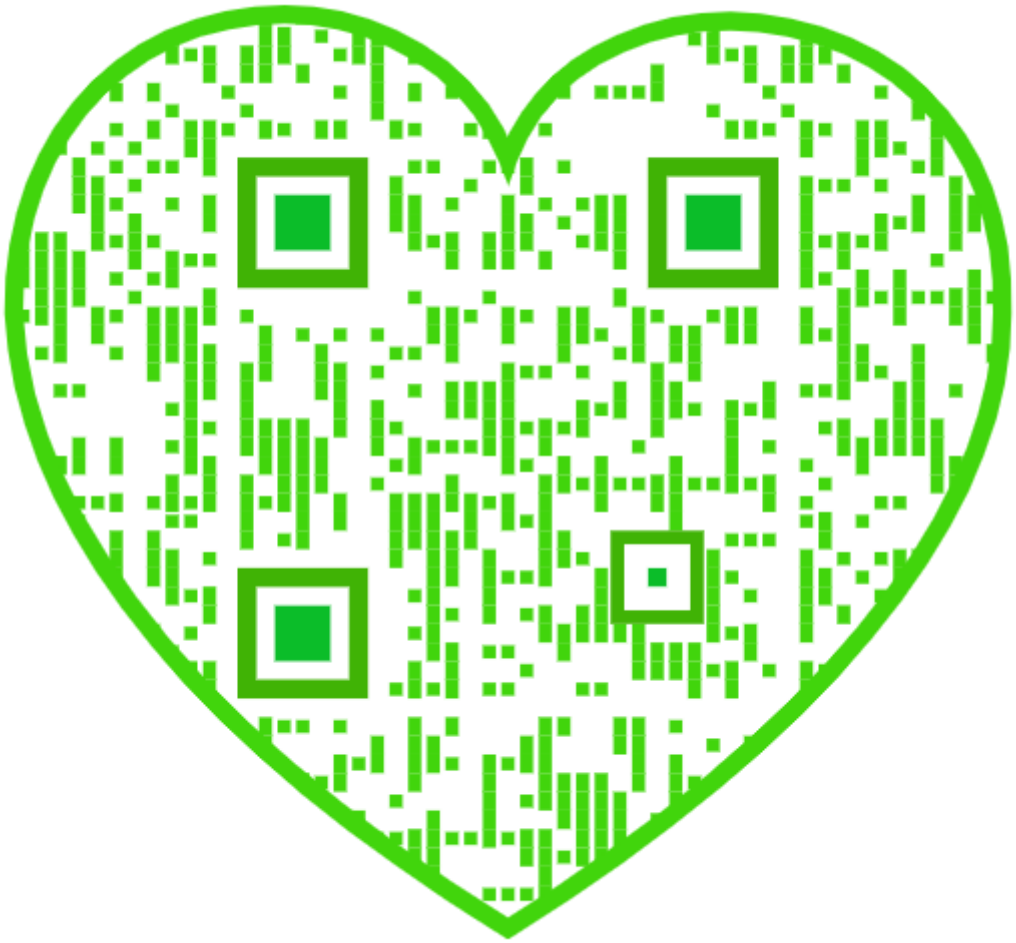

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## THE WILSON COOKED MEAT PATENTS.

The decision of the judges in the cases of the Wilson Packing Company, of St. Louis, against certain Chicago and St. Louis meat canning companies for alleged infringements of the patents of William J. Wilson and John A. Wilson, appears in full in the *Official Gazette* for February 7.

The cases were tried in the Circuit Court, Northern District of Illinois, before Judges Drummond and Blodgett, and were dismissed on the ground that the patents upon which they were based were void for want of novelty. The court also held that in all doubtful cases involving the validity of a patent the fact that the article made by the use of the process described in the patent has been extensively sold is a consideration of great weight, but not enough in itself to sustain the patent. "The rights of the public are to be protected as well as those of individuals, and a monopoly should not be allowed unless the right to it is clearly shown."

The most important questions in the case grew out of the patent of Wm. J. Wilson, reissued April 6, 1875, describing a process of preserving and packing cooked meats for transportation. The process as described consists in first cooking the meat by boiling in water, so that all the bone and gristle can be removed and the meat yet retain its natural grain and integrity. While yet warm with cooking the meat is pressed into a box or case with suitable apparatus, the pressure being sufficient to remove the air and all superfluous moisture, and make the meat form a solid cake. Then the box is sealed or closed air-tight upon the meat.

The court held that the cooking of meat in this way has always been known; that the sealing of the can is substantially the Appert process described in Durand's English patent in 1810; and that the process of pressing meat to remove moisture previous to packing is described in the Marshall patent of 1864. It was also employed by De Lignac in 1855; while cooked meats were canned by Lyman in 1869. The only possible novelty in the process described by Wilson in his original patent of 1874, was the packing of the meat while yet warm with cooking, and this specification (omitted from the reissued patent) cannot, the court held, fairly be considered patentable.

Another element of the case was the form of the can in which the meat was packed, the claims in controversy being the first and third of the John A. Wilson patent of 1877, which claims covered substantially a can of pyramidal form with rounded corners with the ends slightly flaring to form shoulders against which the head or end pieces rest. The can might have any number of sides, four being preferred. The advantage of the pyramidal form lay in its discharging the meat (when opened at the larger end) in a solid cake.

It was shown that this form of can was old. It was described in the French patent of Emile Peltier, recorded in 1859; also that this was a form in common domestic use before the Wilson patent was obtained. In the opinion of the court the well-known glasses and moulds used by housekeepers in domestic life for preserving jellies, boned turkey, head-cheese, etc., were all, from the very necessity of the uses to which they were applied, more or less flaring, conical, or pyramidal in shape, and made so, presumably, for the purpose of turning out or discharging the contents in a solid cake.

Touching the specific construction of the Wilson cans, it was shown that the distinctive features, rounded corners and offset ends, were employed by Gibbie and Perl as early as 1872. The claim as to the form and construction of the can was, therefore, pronounced invalid for lack of novelty. And the same was true of the other claim in dispute touching the method of packing the meat by pressure, with subsequent sealing. Marshall had done the same in 1864, and Lyman in 1870. It was further shown that while the complainants did not confine themselves to the form and construction of can described in the patent on which the claim for infringement was based, the defendant's cans were in all cases made differently. They were made by turning a rim of the head down over the outside of the body or shell of the can and fastening the head with solder—a form of construction practically adopted by the plaintiffs also, "probably because all packers find they can make a can just as tight and useful, and more cheaply, by turning the head over the outside of the shell than by following the exact description of the patent."

The interests involved in these cases are very large; and if the decision of the Circuit Court is sustained by the Supreme Court, the result will be to throw open to public use a process that has been made, by the naturally increasing demand for preserved meats, the basis of a great industry which has been monopolized by a few large establishments.

## RAILROAD COLLISIONS AND THEIR PREVENTIVES.—ROOM FOR INVENTION.

While every precaution which the block system or any other system can devise to prevent collision on our railroads should be encouraged or adopted, it nevertheless will be found impossible, if constant human vigilance is a necessary factor in the means of safety employed, to entirely avoid the recurrence of this class of accidents. The greater the increase of traffic, the greater the danger to which the traveling public is exposed from collisions, and year by year the travel on our railroads increases. Trains following one another in rapid succession, and running at high rates of speed on the same lines of rail, in the dark of night as well as in the light of day, and with the same disregard of fog as of a blinding snowstorm, court danger, and collisions similar to the late Spuyten Duyvil disaster will continue to occur. Collisions in fact, like the assassin's stab, are now more to be dreaded from the rear than from the front, and as human vigilance cannot be depended upon to avoid them, automatic means of securing safety controlled by the engine of a train in motion, or operative only by the undue or improper stoppage of it, should be devised, and, if only as useful auxiliaries, be generally adopted.

If, however, collisions cannot be altogether prevented, there is one thing that can be done to make such accidents less destructive of human life than they usually are, and that is to construct our railroad cars so that they will not crush or telescope. We have no desire to travel in trains which shut up with all the ease of a well-constructed telescope whenever a little sudden resistance is brought to bear upon them. Railroad cars might be constructed so that they could not thus close up and pack one within the other, and from the frequency of these telescoping occurrences we have no hesitation in saying that either the style or construction of the cars now in use on our railroads is defective, so far as their liability and capacity to telescope is concerned, and that some radical change or improvement in the construction of them to avoid this danger is needed.

Furthermore, as the running of one train into the rear of another is now of such frequent occurrence, and as in such case it is generally only the last car or two of the advance or stalled train which are so badly damaged as to occasion any great sacrifice of life, why not make the last car of a train purely a safety one, a sort of buffer car to receive the shock, and from which all passengers should be excluded? Such car need not necessarily be of special construction, provided it and all the cars in the train are of superior rigidity, and so built or framed that they cannot telescope; consequently the delay and inconvenience which attaches to the use of a rear car of different construction from the rest when making up a train would be avoided. Possibly in an overcrowded train there would be a strong temptation to use such car for other than its safety purpose, but this could be strictly prohibited until it ceased to be a rear car by the adding of another. Possibly, also, railroad companies might object on the ground that it was merely hauling dead weight for an emergency which might not occur, forgetful of the fact that in a single accident such precaution would be the means of saving many lives and economical in a pecuniary point of view by reducing claims for damages sustained.

Again, in view of the many burning accidents which have occurred, why should our railroad cars be made of the combustible material they now are, or not be provided with self-operating extinguishing apparatus, or be otherwise heated than they are? But we do not care to pursue this subject further, excepting to remark that if native ingenuity is not sufficient to discover a block system in which the locomotive is the active agent, or to devise a car that will not telescope and when ignited furnish fuel for a fire to burn up human bodies, then we confess to having greatly over-estimated it, and shall be deceived if, in the near future, the means of safety we have suggested, or better ones, be not found, once the tide of invention sets in this humane direction.

## THE PARK ROW FIRE.

The coroner's jury called together to discover the cause of the Park Row fire, find that the fire originated from an overtaxed flue near the front wall of the Nassau street entrance. Further, that the flue was improperly constructed and defective from age, and a recess or chase in the wall cut in close proximity to the flue after the completion of the building, had caused a fracture in the side wall of said flue; the elevator shaft which had recently been erected near the flue, or opposite to it, being a most efficient agent in distributing the flames through the whole building.

One important effect of the fire and the attending circumstances has been to draw public attention very forcibly to the crying need of more and better appliances for rescuing persons beset with flames and for enabling people to escape by their own efforts from burning buildings.

It was seen that an important building in the heart of a great city possessing what is supposed to be the most perfect and efficient fire and water service in the world—a building mainly devoted to business offices and occupied by adults, could be burned in the daytime, and so rapidly that the escape of all the tenants was impossible. It appeared also that the means at the command of the firemen for rescuing persons cut off by the flames were relatively less efficient than they were forty years ago. Their ladders were too short to reach above the third floor, and they had no appliances for getting ropes or other means of escape to the upper floors. A number of those who escaped the flames owed their salvation to the accidental occurrence of business signs nearly connecting with those on the front of an adjacent building, and to the skill and pluck of a passer-by (the black boy, Charles Wright), who climbed an icy telegraph pole and detached a wire stretching from it to the front of the burning building.

These startling discoveries have caused a general awakening—popular and official—to the neglect of life-saving appliances hitherto, and have opened the way to the ready and cordial acceptance of any new devices which may be calculated to prevent similar disasters in the future. Among the devices called for are extension ladders capable of reaching to the upper floors of lofty buildings; means of throwing life-lines to any place where men, women, or children may

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have taken temporary refuge from fire; less obtrusive and more efficient fire escapes, especially such as may be fixed at every window; means by which women and children may be safely lowered from the upper floors of any building, particularly those by which timid and feeble persons may lower themselves; devices for quickly raising rope ladders to any part of a building where they may be needed, or devices by which wire ladders may be stored at the eaves or cornices of buildings over every tier of windows, and dropped by means of appliances within easy reach of any and every window; parachutes; means for quickly cutting away opposing telegraph wires when ladders are to be raised, and so on almost endlessly. It is to be hoped that our inventors will not let the occasion pass without developing something to remove the stain which the too frequent burning of helpless men, women, and children leaves upon our civilization.

## ASPECTS OF THE PLANETS FOR MARCH.

### VENUS

is evening star, and ranks first in importance on planetary records not only during the month, but during the year. She was in superior conjunction with the sun on the 20th of February, when, passing to his eastern side, she commenced her course as evening star. She is now so near the sun as to be hidden in his rays, but as soon as she emerges from his close vicinity she will be a beautiful object in the evening sky, and will reign as queen of the stars in the western heavens until she reaches her inferior conjunction on the 6th of December. Her transit then occurs, the grand astronomical event of the year, and one of the greatest astronomical events of the nineteenth century. It will be safe to say that no object in the heavens will receive, during the year, anything like the attention that will be bestowed upon this peerless planet. Astronomers have been busy for years in getting ready for the transit, for the whole Western world, where the sky is clear, will be in the sunlight during some portion of the passage. The busy notes of preparation are now being sounded in many of the American observatories, where every aid that science can command will be utilized for the occasion, while European astronomers have already formed their plans, received appropriations for the great expenses to be incurred, and chosen stations which are best adapted for observation, as well as those that are at extreme distances from each other.

The phenomenon is not sublime and awe-inspiring, like a total eclipse of the sun; nor simply beautiful, like the conjunction of two planets; nor magnificent, like the telescopic Saturn. The naked eye observer, looking at the sun through smoked glass, will see a tiny black spot passing over his face. The telescopic observer will see a black round ball, as large as the full-grown moon, making its way across the great luminary. The phenomenon to the ordinary observer will be only this and nothing more. But thousands of scientific observers will eagerly note, as if life depended upon the accuracy, the second when Venus touches the sun's edge, the moment when she is fully embarked upon his disk, the exact time of her passage, and the second when her retreating edge touches the sun's edge, as well as the time when the last contact occurs and the exhibition closes. There are two principal reasons for the importance attached to a transit of Venus. One is that it is considered the best means for determining the sun's distance; the other is that it is extremely rare in its occurrence.

Venus and Mercury are the only planets that can make transits across the sun, for their orbits are within that of the earth, and they are therefore called inferior or inner planets. In every synodic revolution, or when earth, planet, and star come into line, these planets must pass between us and the sun, the point being known as inferior conjunction. Venus accomplishes this period in five hundred and eighty-four days. But her orbit, or path, is inclined to the ecliptic or sun's path, and, at inferior conjunction, she ordinarily passes above or below the sun and is invisible. When she is in inferior conjunction, and also at one of her nodes or crossing points, as in December, she passes directly between us and the sun and makes a transit. The transits at the descending node are in December, those at the ascending node in June. The intervals between are eight and two hundred and thirty-five years. The transit of 1874 occurred eight years ago; the next transit after that of 1882 at the same node will be in 2117. The last transit at the ascending node occurred in 1769; the next will occur in 2004.

When in 2004 the next transit of Venus after the coming one takes place, no human being who now treads the earth will be alive to see its passage. Nearly four generations of men will have lived and died before the brightest of the stars again passes between us and the sun when at one of her nodes. Observers will, therefore, witness an event to be remembered for a lifetime, and, for this reason, independent of its scientific importance, the phenomenon will be eagerly anticipated. If astronomers can agree in their calculations and make the transit a means of accurately determining the sun's distance, a great feat will be accomplished. For the sun's distance from the earth is the unit or yardstick for measuring celestial distances outside of the solar system, and on its accuracy the whole celestial structure depends.

Venus will be prominent among themes for astronomical study during the year. She will be far enough from the sun to be picked up by careful observers during the last part of the month. She must be looked for about three degrees north of the sunset point, and soon after sunset. She sets now at eight minutes before 6 o'clock, a few minutes after sunset; at the end of the month she sets about six minutes after 7 o'clock.

### URANUS

is morning star until the 6th, when he comes into opposition with the sun and is numbered among the evening stars. He is then at his nearest point to the earth, the sun, the earth, and Uranus being in a straight line, with the earth in the center. At this time he is seen opposite the sun in the heavens, as the word opposition implies, rising when the sun sets, and setting when the sun rises. A far more important epoch than his opposition occurs also during the month. On the 25th, he reaches his perihelion or nearest point to the sun, and is the second of the four great planets to reach this part of his course. Jupiter arrived at the goal in 1880, and Neptune and Saturn will take their turn in the near future.

The occurrence of the perihelia of the four giants of the system within a few years of each other is an event that has not happened for many centuries, and will not be repeated for many centuries to come.

Uranus was discovered by Herschel in 1781, the centennial anniversary of the discovery occurring last year. At perihelion he is one hundred and sixty million miles nearer the sun than at aphelion, and as his opposition and perihelion are nearly coincident he is just so much nearer the earth. Yet such is his immense distance that the approach will be hardly perceptible in appearance. It will be eighty-four years, the time of his revolution, before the conditions are repeated, and the present is, therefore, a favorable time for beholding the faintest and smallest of the visible planets. A keen-eyed observer will have no difficulty in finding him on a clear, moonless night, as he tracks his slow course in the constellation Leo. His right ascension is 11h. 8m., and his declination is 6° 23′ north. He shines as a star of the sixth magnitude, and must be looked for in a line with Regulus, the brilliant star in the handle of the Sickle, and forming a right angled triangle with Regulus and Denebola, a bright star in the tail of Leo.

Uranus now rises at eleven minutes after 6 o'clock; at the end of the month he sets at eight minutes after 4 o'clock in the morning.

### MERCURY

is morning star throughout the month. He reaches his greatest western elongation or most distant point from the sun on the 21st. He is then in one of the three favorable positions for observation as morning star that occur during the year. He will be an interesting object between the middle and close of the month, reigning alone as morning star, and lovely beyond description as he heralds the sun's approach. He must be looked for eleven degrees south of the sunrise point and about half an hour before sunrise. Mercury rises now at a quarter before 6 o'clock; at the close of the month he rises at 5 o'clock.

### SATURN

is evening star, and is becoming an object of lesser interest, as growing dim in luster, and traveling from the earth he approaches conjunction with the sun, when for a time he will disappear from view. He passes the meridian at a quarter before 4 o'clock in the afternoon, so that he is well advanced on his western course when twilight fades and he comes into view. Saturn sets now at half past 10 o'clock; at the close of the month he sets about a quarter before 9 o'clock.

### NEPTUNE

is evening star, following closely after Saturn and bound for the same goal—conjunction with the sun. He passes the meridian only twenty-three minutes after Saturn. If his nearness corresponded with his dimensions, for he is only exceeded in size by Jupiter and Saturn, we should have great enjoyment in watching his movements as he threads his way between the two great giants of the system. But his diameter is not nearly half that of Jupiter, and he is more than five times as far away. Neptune sets now not far from 11 o'clock in the evening; at the close of the month he sets a few minutes after 9 o'clock.

### JUPITER

is evening star, and, though still the brightest of the heavenly host, is lessening in interest as his distance from the earth increases. He follows closely in the track of his two brother planets, passing the meridian about twenty-one minutes after Neptune. He has lessened perceptibly in size and brightness, for his disk now measures thirty-five seconds, while at opposition last November it measured forty-seven seconds. Jupiter sets at half past 11 o'clock; at the end of the month at 10 o'clock.

### MARS

is evening star, and diminishing in interest as he travels on the long road that leads to his next opposition in January, 1884. He is, however, a beautiful member of the starry throng as looking down from the zenith in the early evening he beams with ruddy light and finds few rivals among the fixed stars. Mars now sets a few minutes after 3 o'clock in the morning; at the end of the month a few minutes before 2 o'clock.

Interesting objects for telescopic study will not be wanting during the month. Uranus, through a good telescope, will come into view as a small full moon of a delicate sea-green tint, and two of his four moons may be picked up. Jupiter still rewards the observer with a view of his northern belt, his southern red spot, and his equatorial white spot. Venus, close to the sun, takes on the gibbous phase of the moon just after the full. Mercury, at his western elongation, presents the aspect of the moon at her first quarter. Mars shows dimly his northern polar cap and the delicate markings of his oceans and seas.

The March moon fulls on the 4th, but her movements are not of special interest. The new moon of the 19th passes, on the 22d, near Saturn and Uranus, and on the 23d near Jupiter, when the evening sky with the three days' old crescent and the radiant planets will be fair to see.

The heavens present a delightful planetary picture during the month of March. Uranus, our far-off brother, reaches opposition and perihelion; Venus, at its close, will be seen in the glowing west just after sunset; Mercury will beam in the morning light; Saturn, Jupiter, and Mars will move in their appointed course as they approach the source of life and light. Thus, the planets as they track their devious path among the shining stars, not only illustrate with them the amazing beauty of the star-lit heavens, but also the variety that lends its never-failing charm to the science of astronomy.

## Better Thermometers Wanted.

It would appear, from the following remarks by the London *Engineer*, that there was plenty of room for the discovery of improved thermometers, capable of correctly registering low temperatures.

Experiments at the Meteorological Observatory at Kew have proved that ordinary thermometers are "very wild" below the freezing point of water, and that the low temperatures announced as having been produced by apparatus for freezing meat on board ocean-going steamers are liable in some cases to serious question. Some of the thermometers used for the indications have been found to be inaccurate to the extent of more than 50° Fah., and one was 100° out. A thermometer, a relic of one of the earlier Arctic expeditions, was recently tested at Kew. At 40° Fah. it was 15° out, and at 100° Fah. it was 30° wrong. The demand for trustworthy thermometers for circumpolar and northern meteorological stations, as well as for meat freezing machines and various scientific purposes, has induced the authorities at Kew to test the instruments at the temperature of melting mercury, the air thermometer being used for lower temperatures should exceptional circumstances require it.

The freezing point of mercury, —37·9° Fah., was first determined by Dr. Balfour Stewart, and his observations were subsequently confirmed by other observers. Between the freezing points of water and mercury no intermediate fixed point is known, although methylchloride is supposed to furnish one. It is difficult to get this chloride in a solid state.

On Thursday, last week, for the testing of a thermometer to be used with meat freezing apparatus, also a thermometer for a meteorological station in Norway, about a pint of mercury was poured into a wooden cup, which cup was surrounded with a covering of boiler felt, which again had an outside wooden cover. Solid carbonic acid was made in the usual way by the evaporation of some of the liquid carbonic acid from an iron bottle into which 200 gallons of the gas had been compressed. Lumps of the solid acid were then placed on the surface of the mercury, a little sulphuric ether was poured over them, then the lumps were pressed down into the mercury with a wooden spoon. This produced a hissing and a bubbling from the escape of carbonic acid gas.

After the operation had been several times repeated, lumps of solid quicksilver began to form; some of them, rich in gas bubbles, floated at the top; others sank to the bottom, for mercury, unlike ice, is heavier than the liquid in which it is formed. The lumps, some of them hard and some soft, were constantly broken up as much as possible with the wooden spoon, the great object being to get a thick layer of soft mercurial paste at the bottom of the vessel in which to plunge the thermometers during the observations.

The whole operation appeared to the onlookers to be simple and easy enough, although in the last generation the freezing of even a small piece of mercury was considered such a wonderful feat. Four standard Kew thermometers were then placed in the mercurial paste, and those to be tested were inserted alongside, their errors in indication being written down on paper. The possibility of all four of the Kew thermometers going wrong at once is not to be supposed, consequently the values of the indications of the thermometers on trial are well tested.

## Why Some Oysters are Green.

A great deal has been written in regard to the peculiar green character of European oysters, and in certain varieties of these shell-fish their value abroad seems to depend on the intensity of color. For those who like such green oysters it may be stated that there are localities in the United States where oysters of the most pronounced verdigris tint can be obtained. Prof. Ryder has found that the coloring is not due in American oysters to the green diatoms on which the oysters largely feed, as was supposed by M. Puysegur to be the case in French waters. In experiment on the green color in Chesapeake Bay oysters, it was found, on drying the substance, that it faded out in time. Prof. Ryder is disposed to believe that it is composed of an immense number of glandular cells, containing chlorophyl, and is due to a vegetable parasite. In this method of coloration oysters would not differ from certain mussels which, as Prof. Leidy has shown, owe their peculiar green tinge to the same substance.

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### FRAGER'S WATER METER.

[*Continued from first page.*]

also very simple. The lever, L, carries a pawl, Q, moving about a vertical axle. When the lever is placed toward the left the pawl engages with the ratchet, R, and causes it to move forward one tooth in pivoting itself around its own axis. When the lever turns backward the catch of the pawl becomes disengaged, and is carried back to its starting point by the action of the center of the ratchet wheel on the tail of the pawl. The ratchet wheel itself moves the clock work by means of an axle, which, after passing through a stuffing-box, enters the clockwork case. Finally, the meter is provided with an ingenious arrangement which allows the fact to be ascertained at any moment as to whether the apparatus is water-tight. To effect this object, the cams, $H_2$ and $H_4$, of the piston, P′, are made helicoidal in shape, so that if the piston rod (and consequently the cams) be revolved about half a turn to the left, the cam, $H_2$, in consequence of its peculiar shape, is thrown out of the way and no longer engages the lever, L′, to a sufficient degree to displace the slide valve, T. The piston, P, will then remain pressed close up against the left end of the cylinder, and the piston, P′, against the right end. The meter will thus stop working, and the flow of water will cease entirely if there be no leak. To set the meter in operation again, it is only necessary to move the stoppage eccentric back to its first position, when the helicoidal flange of the cam, $H_2$, acting on the lever, L′, and displacing the slide valve, T, will put the apparatus in motion. If, after bringing back the stoppage eccentric to its proper position, it be immediately turned to the left, the apparatus begins operating and stops anew after distributing four cylinderfuls. It is easy then to ascertain: (1) Whether the meter has any leaks; and (2) whether the capacity of the four measuring cylinders is in proper accordance with the clockwork.

The apparatus is easily taken apart and put together again, and, as regards construction, is exceedingly strong. With the exception of the piston packing (which is rubber), all the parts are of metal. There is hardly any need of speaking of the applications which may be made of the water meter. But there is one, however, which we consider proper to dwell on, since it offers to manufacturers a means of controlling the operations of their generators and engines. It is the measurement of the feed water.

By a special arrangement, the meter may be placed on the supply pipe of the feed pump. There is a safety valve provided for the prevention of accidents, and a check valve for preventing back flow from the boiler. From the very construction of the apparatus, it is able to work equally well with either hot or cold water. The exact knowledge of the quantity of water vaporized by the boiler allows, by comparison with the weight of coal consumed during the same time, of ascertaining with the greatest certainty the cost per pound of steam, and of determining the choice of coal. Besides this, if the revolutions of the driving shaft of the engine be counted, the expense of steam per revolution of the flywheel may be estimated; and thus the movements of the engine can be regulated so as to prevent that increase in the consumption of fuel which follows an excess of speed. The use of the water meter and of the revolution counter results then in a considerable reduction in the expense of fuel, while at the same time it allows the behavior of the boilers and engine to be ascertained at any moment.

### Boiler Explosion in Brooklyn.

Just before noon, February 16, two of the three large boilers of the Brooklyn City Flour Mill exploded with great violence. The mill was situated at the foot of Fulton street, in close proximity to the terminus of many city railroads and to the landing place of the Fulton Ferry; and though the neighborhood is usually thronged with people not more than a dozen persons were injured by the flying boilers and timbers. The engineer was killed. The exploded boilers were horizontal, 7 feet in diameter and 21 feet long. They were made in 1861, and were under the charge of the Hartford Steam Boiler Inspection and Insurance Company at the time of the explosion. The boiler house, a one-story brick structure, about 25 x 50 feet, was entirely destroyed. It contained three boilers, one, built ten years ago, was thrown seventy-five feet, but remained unbroken; the other two were ruined. One of them, it is said, was hurled straight upward as high as the third story of the main mill building. The mill was owned by a company, of which General N. W. Slocum is president, and the Jewell Brothers are managers.

### APPARATUS FOR EXTRACTING AMMONIA FROM GAS LIQUORS.

In the SCIENTIFIC AMERICAN SUPPLEMENT, No. 281, of May 21, 1881, we give a description of an apparatus constructed by Dr. H. Grüneberg, for extracting ammonia from gas liquor. This apparatus appears to have been based upon the prior invention patented by Messrs. Elwert and Müller-Pack, Sept., 1874, and now assigned to Brustlein, Sury & Co., New York, of which we now present an engraving

The patented apparatus has a long and successful past to testify in its favor, having been in use since 1874 in various large gas works, especially in Europe, where universal and entire satisfaction is expressed concerning its economy, efficiency, and purity of product.

The patented apparatus of Messrs. Elwert and Müller-Pack shows two tubular horizontal boilers (14x3), one placed above the other, constructed so as to allow the emptying of the upper into the lower boiler by means of a connecting pipe with cock. Each boiler has the capacity of one ton of gas liquor and from 90 to 120 lb. of milk of lime. Both ends of each boiler are provided with manholes, to enable easy access for cleansing purposes, once in two or three weeks. Only the lower boiler is heated directly, and a bent tube runs up from its dome (steam drum) and down again to the upper boiler, where it continues along the bottom of same, being perforated on its horizontal part with numerous holes. From the dome of the upper boiler a pipe leads through a preliminary condenser, the condensed liquor being brought back to the upper boiler by means of a pipe, and then through a cooling worm or refrigerator, out of which a pipe conducts into a vessel provided with a safety-tube, where the vapors condensed by the cooling coil are collected, and are sucked back to the upper boiler each time the latter is charged with crude liquors and lime.

From the reservoir succeeding cooling coil a pipe enters a series of four charcoal purifiers, thence into a condensing cistern, and from this again to an additional condenser, from which a pipe opens in the air. The two last condensers are each provided with emptying pipes and safety-tubes.

The action of the apparatus is now as follows: The refrigerator and the two last condensers being filled with cold water, and the charcoal purifiers charged, about one ton of gas liquor and the necessary milk of lime are introduced in the upper boiler, and this boiler emptied into the lower, where the fire is started, the cock of the connecting pipe being closed again. The vapors now arising in the lower boiler will soon have expelled all the air in the apparatus, after which the upper boiler is again charged as at first, and the fire under the lower made active. The vapors now coming from the lower boiler and entering the upper through the bent tube will be forced through the perforations in its horizontal part at the bottom of the boiler, and violently agitate the fluid, thus advantageously substituting an agitator, and the vapors by rising will become purified and enriched with ammonia from the liquid.

The vapors are then conducted into the first condenser, a closed reservoir, which chiefly retains all the scum, and where also some of the ammoniacal salts are condensed, which all flow back to the upper boiler, while the concentrated vapors pass through the refrigerator or cooling-worm, and thence to the second reservoir, where the products of condensation, aqueous vapor, with a portion of the hydrocarbons, free ammonia, and ammoniacal salts, are deposited, but the incondensed vapors escape and enter the charcoal purifiers.

The fluid deposited in the reservoir, which follows cooling-worm, assists toward the end of the operation, when the vapors are more fully charged with ammoniacal salts, in washing the vapors and retaining the salts, and is sucked back to the upper boiler again each time that it is charged with gas liquor, this cold gas liquor producing a vacuum in the boiler, which vacuum at the same time causes a quicker disengagement of ammonia in the lower boiler.

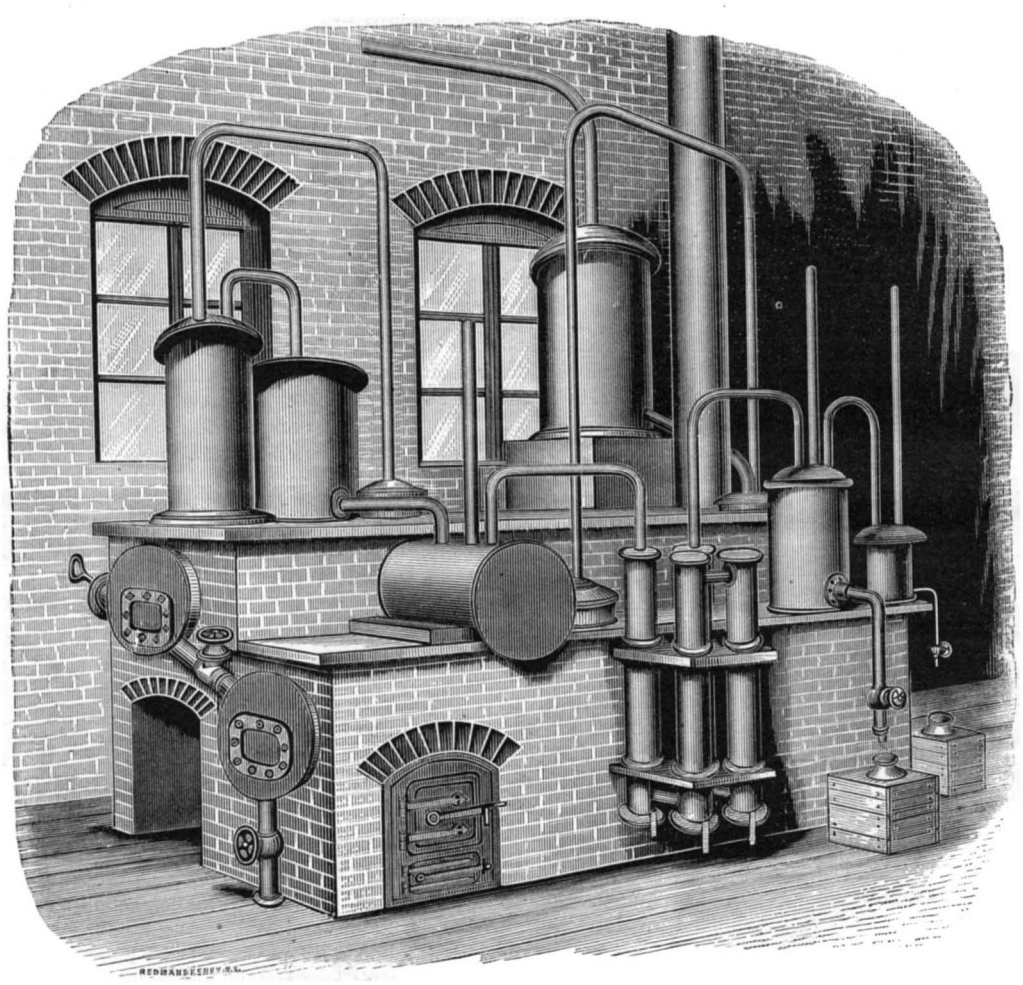
The application of the liquid in the reservoir has also the advantage of washing away any deposit left in the cooling-coil and succeeding pipes, as well as in the pipe directly connecting said reservoir with the upper boiler.

The charcoal purifiers absorb all the matters that would impure the alkali, such as the hydrocarbons, and the purified vapor enters the condensing cistern, the pure water therein absorbing the vapor until it has gained the desired percentage of ammonia. The slight residue of incondensed vapor is conducted into the last condenser, where the remainder of the ammoniacal vapor is absorbed.

After about four or five hours the lower boiler will have discharged all its ammonia, when the liquid is let out and the boiler again charged from the upper boiler, which is charged with crude liquor. During this time the purifiers may be repacked, and the liquid ammonia drawn off from the two last condensers, which must again be filled with the necessary quantity of fresh water.

Thus, from one charge, after four hours, about 200 lb. of white volatile alkali, marking 26° Baumé, are gained, perfectly pure, only needing to remain quiet several hours in order to deposit all the lime and magnesia salts caused by the water, if no distilled water is used.

For 100 lb. alkali only 27 lb. of coke are required, and two men can easily run the whole apparatus. The entire process is of course more simplified and becomes more economical the larger the works, and it can safely be said that no apparatus is more efficient and gives purer products. In manufacturing on a large scale an allowance need be made for but one man per apparatus. As each apparatus can perform from five to six operations per day, a set of two apparatus can easily produce over two tons of ammonia daily.



**ELWERT & MULLER-PACK'S APPARATUS FOR EXTRACTING AMMONIA FROM GAS LIQUORS.**

### Mescal and the Useful Agave.

One thing at least peculiar to the American Indian diet is the *mescal*, derived from the roots of a species of century plant. On all the dry hills of the Colorado desert section, a species of this plant is met with, the *Agave deserti*, and when other food resources fail this is never wanting. As an article of diet it is prepared by exposing the thick portion of the plant at the root of the leaves, to a smothered roasting in a pit filled with hot stones and covered over with leaves and rubbish. When sufficiently cooled off the mass of cooked plants is ready for use, being cut in slices, which have a dark mahogany color, and charged with a sugary juice, resembling molasses candy, and if equally clean, quite as palatable. This is greedily eaten, both as an article of diet and luxury, the only disagreeable consequences being a tendency to bowel complaints, especially when exclusively used. It is perhaps a matter of congratulation that none of our Indian tribes have advanced so far in civilization as to learn the art of extracting alcoholic products from this plant, otherwise we might have less to say in praise of their peaceful character.

A better use of this plant is that which is derived from its textile fibers, and here Indian skill and patience are exhibited in the various articles of netting and rope constructed from its leaves. All through the table lands of Mexico this textile fiber is extensively used, and brought into market in substantial fabrics, including bagging, matting, and occasionally fine textile work, colored by native dyes. And this naturally suggests the possibility of new branches of industry for California, where the plants can be grown without irrigation on the driest soil, and the present enormous tax on sacking for the shipment of grain be kept in the country.—*San Francisco Bulletin.*

### A Large Tumor.

At the Hospital of the University of Pennsylvania, February 10, Dr. William Goodall removed an ovarian tumor weighing 112 pounds. The patient, 31 years of age, weighed only 75 pounds after the operation. The doctor naively remarked that he had taken the woman from the tumor. There was a fair prospect that the patient would survive the operation.

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### IMPROVEMENT IN REVOLVING FIRE ARMS.

The engraving shows an improvement in revolvers, of the class in which the cylinder is arranged to swing outward from its place in the frame, so as to expose the chambers in the cylinder for the insertion and removal of the cartridges or shells. The improvement consists in an ejector which automatically throws all the shells or cartridges from the cylinder which may be in the chambers when it is turned outward from the frame. A part of the frame is made to serve as the center-pin on which the cylinder revolves, it being arranged to swing on a pivot, the axis of which is parallel with the axis of the cylinder. There is an ejector arranged at the rear end of the cylinder to engage the heads of the several cartridges, and mechanism operated by the outward-swinging movement of the part of the frame which supports the cylinder, to give to the ejector the rear movement to force the shells or cartridges from their respective chambers. The frame or receiver, A, is of substantially the usual outline, constructed with a recess for the cylinder B, and provided with the barrel C, hammer D, and lock mechanism, by which the cylinder is rotated to successively present the cartridges introduced into the chambers in line with the barrel for discharge.

On the swinging part E′, above the pivot $E^2$, parallel with it and concentric with the cylinder, is the center-pin $E^3$, which forms the bearing on which the cylinder turns. This pin is made tubular or hollow. At the junction of the pin and the swinging part E′, there is a projection or shield, *e*, which overlaps the adjacent part of the frame and prevents gas from entering at the joint. The cylinder is fitted upon its center-pin or bearing $E^3$ so as to turn freely, and the relation of the parts is such that when the swinging part is closed, the cylinder is in its place of rest in the frame; but when the swinging part is turned away, as in Fig. 2, the cylinder moves out from its place in the frame sufficiently far to expose the chambers for the insertion or removal of the cartridges or shells.

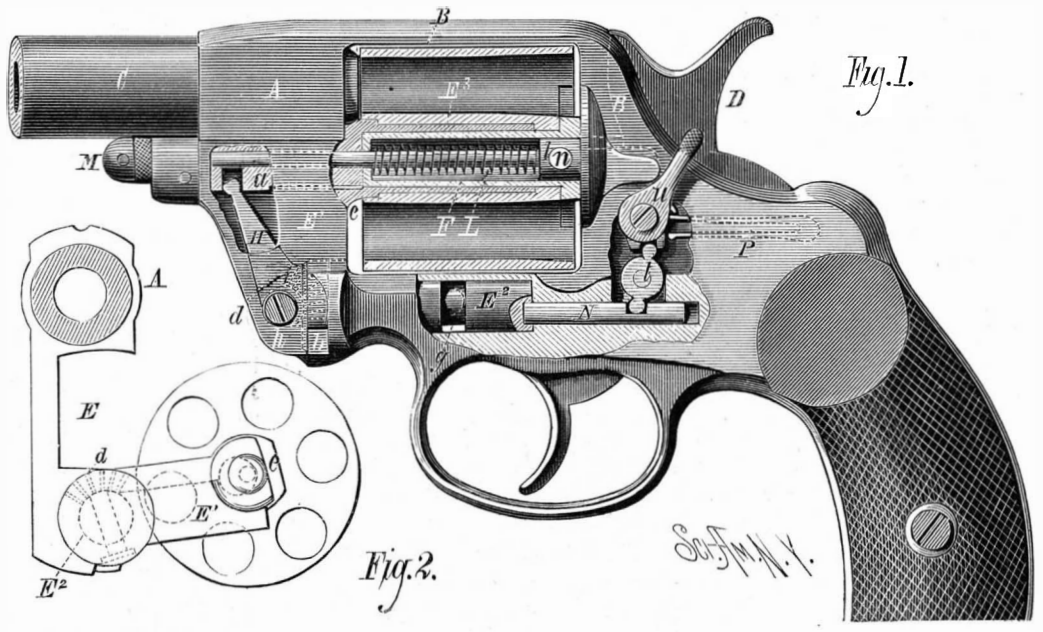
Within the center-pin $E^3$ the ejector-rod F is arranged so as to move longitudinally. On the rear end of this ejector-rod the ejector-plate is arranged. This plate is of star shape, its arms extending outward between the chambers, and so that, when in its place in a recess in the rear end of the cylinder, these arms or part of the ejector-plate will lie at the rear edge of the chamber, so that the heads of the cartridges inserted therein, or a portion of each, will rest on this plate, so that when the ejector is thrown outward, it will force the cartridges or shells from the chambers of the cylinder.

The ratchet by which the cylinder is rotated, is attached to or made a part of the ejector-plate. To give the ejector the required rearward movement as the cylinder is turned outward, a follower, *a*, is arranged in the swinging part E′ parallel with the axis of the cylinder, and in line with the ejector-rod F, and bearing against its forward end, as seen in Fig. 1. This follower *a* is made eccentric to the center-pin against the ejector-rod, so that the rear movement of this follower will correspondingly force the ejector rearward.

Loose on the pivot $E^2$ is a ring, *b*, seen front view in the small figure, which is free to turn on the spindle, yet will turn with it when the part E′ swings outward or inward. On the front face of the ring *b* is a bevel segment-gear *d*, and forward of this ring, in the swinging part E′, is an arm H, upon a pivot, *h*, the axis of which is at right angles to the axis of the ring. This arm is shown detached in the small figure.

At the lower end of the arm H, and concentric with its pivot, is a segment, *d′*, which works in the teeth *d* of the ring *b*. Their relative arrangement, as seen in Figs. 1 and 2, is so that their toothed portions *d d* work together like a pair of bevel-pinions.

As seen in Fig. 1, the arm H is in its extreme forward position—that is, in place, with the ejector home. When the swinging part E′ is turned outward, the ring *b* will turn with it, the center of motion of the swinging part being the axis of the ring. If, therefore, the movement of the ring *b* be not interrupted, it can have no effect whatever upon the arm H; but if during the swinging movement the ring *b* be stopped, then, the swinging movement continuing, the teeth *d′* of the arm H, which are swinging upon the same center as the swinging part, will be forced to travel through the then stationary teeth *d* on the ring, which will impart to the arm H a movement on its center corresponding to the movement of the swinging part on its center, which will turn the arm H rearward, in a plane parallel with the axis of the cylinder. The rear movement of the ejector must not occur until after the cylinder has been turned so far from the frame that the heads of all the cartridges are exposed outside the frame, and that its movement may commence at this time a shoulder, is made on the periphery of the ring *b*, and a corresponding shoulder on the frame below, so that as soon as the shoulder on the ring strikes the shoulder on the frame the further turning of the ring will be arrested. Then as the swinging part continues its movement to the position indicated in the smaller figure the ring will remain stationary, and the arm H will be turned from the position in Fig. 1, and force the ejector rearward from the cylinder, so as to discharge the shells. This invention was lately patented by Mr. William Mason, of Hartford, Conn.




MASON'S IMPROVED REVOLVER.

### Fine Drilling.

Professor Edward C. Pickering, of Harvard College, says that, in undertaking to measure the intensity of the light of the satellites of Mars, he had occasion to need an extremely small hole. A hole about the *twenty five-hundredth* part of an inch in diameter was finally secured.

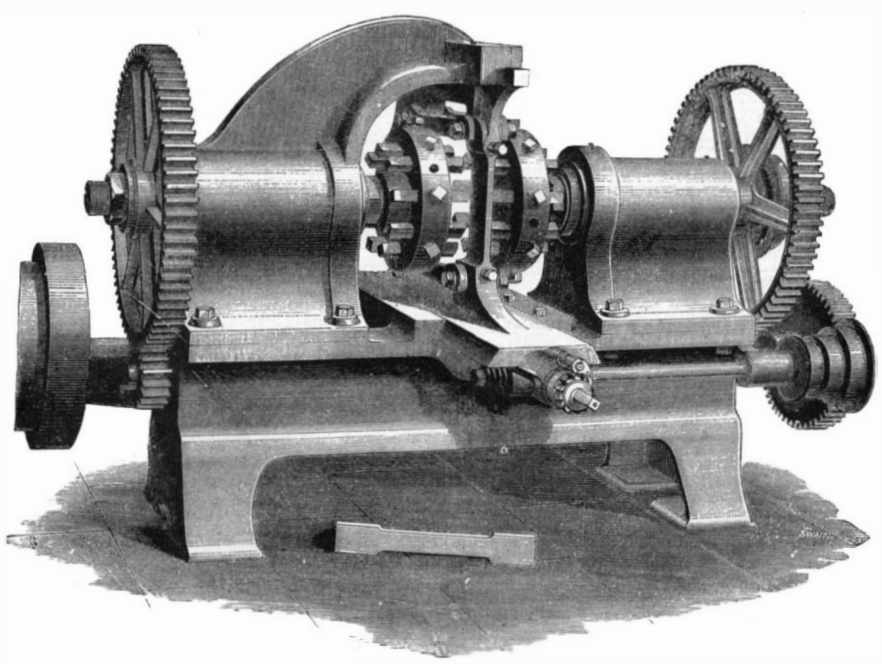
### IMPROVED TESTING MACHINE.

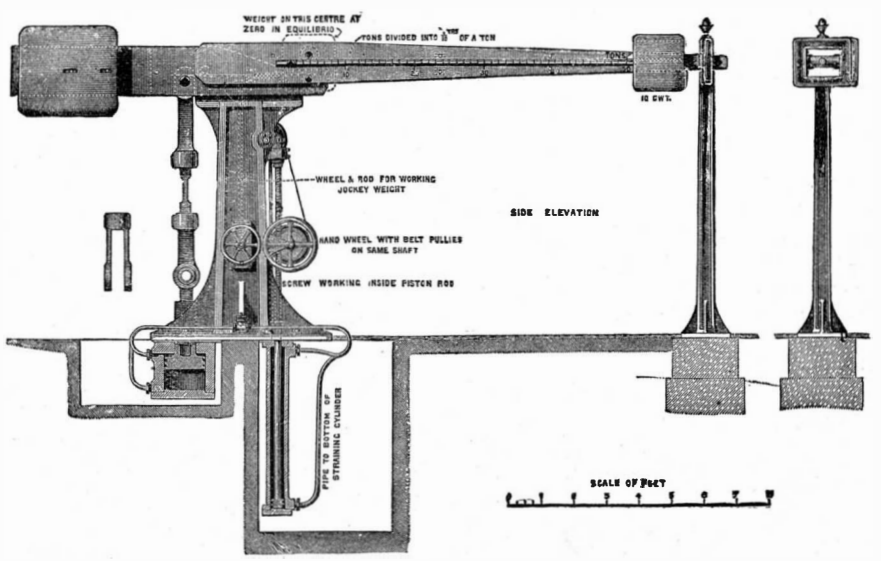
In order to meet the increasing demand for mild steel ship and boiler plates, and also to carry out the requisite tests—tensile—specified by the Admiralty, Board of Trade, Lloyd's and Liverpool Registry, Bureau Veritas, etc., the Steel Company of Scotland found it necessary to have a machine capable of getting through a great number of tensile tests in a comparatively short time with precision and accuracy, and also to save the delay and inconvenience to which shipbuilders and boiler-makers were subjected when the materials had to be tested at their own yards.

Through the inefficiency of the hand-moved machine at the works, the machine we illustrate was designed by Mr. Thomas Williamson, works manager to the Steel Company of Scotland, and was made by Messrs. Westray, Copeland & Co., of Barrow-in-Furness. It has been in use for about two and a half years, and has been found to fulfill all the requirements in a satisfactory manner. The average number of tensile tests, for several months' actual work, was ninety per day of nine hours, or ten per hour, and the machine is capable of breaking one test piece every two minutes with perfectly accurate results, whence it becomes a question of measuring, checking, calculating, and reducing the strains per square inch, etc., in order to keep pace with the work of the machine. The labor has been reduced by one-half, while the work done has been increased about two-thirds per day, thus effecting a great saving in time and labor.

The machine is driven by two hydraulic rams, the small one for forcing and the large one straining. The small forcing ram—pump—is worked by a screw driven by worm gear and strap by power from line shafting, which arrangement gives a steady flow of pressure in the large cylinder, and does away with the objectionable intermittent reciprocating action of the ordinary plunger pumps, which may affect the real accuracy of a test when strain has gone beyond the limit of elasticity. The capacity of the forcing to the straining cylinder is such that the cubic contents of both are nearly equal, so that the displacement is nearly the same at either side of the piston, the one forcing and the other drawing, the water leaving the bottom side of the large ram while it is being forced down on the top side; therefore, when a piece is being tested and it breaks, the water under the ram acts as a stop and so prevents it from falling through any distance, and thus causing a sudden jar on the ram or steelyard levers, which jar is injurious to the knife edges of the machine.

The levers are compound and of the first and third orders, are graded 100 to 1, and balanced; the fulcrums have long knife bearing edges, viz., one inch equal to five tons, and are hardened to wear well. The traveling jockey weight, which is 10 cwt. standard imperial weight, runs on rollers guided by a groove, and can be worked automatically or by hand out and in on the main lever, which is just kept floating at the level of a finger pointer fixed to the column. The jockey weight is worked by a quick pitched screw through the center of the main lever, which is in turn worked by a pair of small toothed wheels, one of which is fixed to the machine column, and the other to the lever and on the dead center of the first lever. The pitch line of the toothed wheels being exactly in a line with the dead center knife edge, the motion at this point is virtually nothing. It is at the same time at right angles to the line of knife edge, conse-




WEIGHT ON THIS CENTRE AT ZERO IN EQUILIBRIO
TONS DIVIDED INTO 20TH OF A TON
10 CWT.
WHEEL & ROD FOR WORKING JOCKEY WEIGHT
SIDE ELEVATION
HAND WHEEL WITH BELT PULLIES ON SAME SHAFT
SCREW WORKING INSIDE PISTON ROD
PIPE TO BOTTOM OF STRAINING CYLINDER
SCALE OF FEET

FIFTY-TON TESTING MACHINES, DESIGNED BY THOS. WILLIAMSON.

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quently cannot disturb the sensitiveness of the steelyard when in operation. The machine is fitted with strong steel links, the top one being on knife edges on the lever, and the bottom one receiving the screw for adjusting the length for the test pieces; the screw is secured inside the trunk of a large ram. The ends of the links for receiving the test-pieces have round sockets with circular glands let into them, into which are fitted the tapered grips, so that the grips can be adjusted and turned in either direction, either to stand across or lengthways of the machine. The machine is specially adapted for tensile testing, but can be easily made to do either compression or bending testing if required. The machine is compact and easily got at for repairs, examining and readjusting knife edges; it takes up little space, and the gearing, being a worm and screw driven by belts, is noiseless. The levers, links, and ram are made of Hallside steel.

Another machine of the same description has just been erected at the Steel Company of Scotland, Blochairn Works, Glasgow.

Along with the testing machine it was deemed necessary to have a machine capable of preparing the requisite number of test-pieces to keep the testing machine fully employed, and for this purpose the test-piece shaping machine was designed by Mr. Thomas Williamson, and made by Messrs. Joshua Buckton & Co., Leeds. The pieces, about twenty-five in number, of various thicknesses, and from one and one-half inches to two inches broad, just as they are cut at the shears, are put into the frame which forms a slide working across the bed of the machine; the pieces are roughed down and finished in one operation to a breadth of one inch to three-quarters of an inch; they require no filing up, except taking off the ragged edge, when they are ready for testing.

The average working of the machine is 150 test-pieces per day of nine hours. It is a strong, substantial machine, and has given great satisfaction both at Blochairn and Newton, and can prepare more than double the usual number of test-pieces at half the former cost, so that it forms a valuable adjunct to the lever testing machine.—*The Engineer.*

### Comparative Studies of American and European Oysters.

There is promise that many doubtful points in the natural history and physiology of oysters will be cleared up by the work now going on at the Philadelphia Academy of Sciences under the direction of Prof. John A. Ryder. The observations of Prof. Brooks (already described in these pages) seemed to show that the reproduction of American oysters—some of them at least, is a radically different process from that of the European oyster, or else that European observers had erred in deciding the oyster to have both sexes in one animal. Professor Ryder has been supplied with Chesapeake oysters by Mr. Ferguson, Commissioner of Fisheries for Maryland, and with a variety of European oysters by Mr. Blackford, of the New York Fish Commission, including those known as Mulford natives, Burnham natives, Mulbles, and Colne oysters, coming from England, and the Scotch, Dutch, French, and Anglo-Portuguese oysters.

The Dutch oysters have a thin covering, the lower valve quite convex, the upper flat, and the outline fairly circular, while the Burnham and Mulford natives the French and Scotch shells, approach more nearly to our own forms. As a rule, there are, however, marked differences in the shell when opened, so much as to make them quite evident, though even to this there are exceptions.

In the American oyster the great muscle has a distinct purplish color on the shell. In the majority of European oysters there is no color. A French or Dutch oyster may be opened, and, although just where this muscle has been imbedded on the nacre a slight depression is visible, there is no color. Again, the outline of this muscle on the shell differs in European oysters. It is not broad, like a thumb-mark, as it may be roughly described, as found in our own oysters, but it is elongated, longer than it is broad. The exception to this want of color on the shell was found in oysters of Portuguese origin. There does, however, exist some slight differences in the structure of this muscle, and it appears to adhere on both sides in European oysters rather more tenaciously than in American oysters.

The Portuguese oysters transplanted into English waters presented the greatest differences of shell. The lower valve is exceedingly deep, resembling a miniature gravy boat. An oyster about three inches long had at its hinged end a depth of over an inch. This cup-like base necessitated, on the part of the oyster, a complete upward turn of the covering valve, so that in a perfect specimen the curve in the outline was very conspicuous.

In the structural form of the oyster it is said that Prof. Ryder has made some important discoveries, which will undoubtedly attract the attention of microscopists. The reproduction of these oysters is still under investigation. It would seem, however, that in the Anglo-Portuguese oysters transplanted to English from Portuguese waters—the reproductive organs are the same as those of American oysters as observed by Prof. Brooks.

### The Protective Effect of Vaccination.

Dr. Henry Tomkins, medical superintendent of the fever hospital belonging to the Manchester Royal Infirmary at Monsall, in a paper which he read recently at Owens College, said: "The most striking of all evidence is, perhaps, that derived from the smallpox hospitals themselves. Here the protective influence of vaccination is seen and proved in a manner beyond all cavil. At Highgate, during an experience of forty years, no nurse or servant, having been revaccinated, has ever contracted the disease, and evidence of the same character I can myself bring forward, for during the whole time that I have had charge of the fever hospital, more than a thousand cases of smallpox have passed under my care, yet no servant, nurse, porter, or other person engaged there has, after revaccination, ever taken it, though exposed daily to infection in its most concentrated form. One woman, a laundress, who escaped vaccination, took the disease and died; one nurse, who some years before had suffered from smallpox, and was then considered protected, had a very mild attack; and this summer a workman, who did not live on the premises, but came in to work as a painter, was not vaccinated, and had rather a severe attack; and still more recently a servant, who by an oversight was allowed to go about her work three days before being vaccinated, had, before the latter had run its course, a slight abortive attack. Again, among all the students who, during the past two years, have attended the hospital for clinical instruction, not one has suffered, all having been revaccinated before being permitted to enter the smallpox wards. And in their case the false argument which opponents of vaccination have brought forward to explain the immunity enjoyed by nurses and others in attendance on the sick, viz., that constant intercourse and exposure to infection renders them proof against it by the system becoming inured to the poison, cannot be applied, as these gentlemen attend the hospital only a few hours once a week. I defy the most enthusiastic or conscientious of anti-vaccinators to produce evidence like this on his side of the question, or to bring forward even half-a-dozen persons, choose them whence he may, who have not been protected against smallpox, and expose them as the students are exposed, without more or less of the number taking the disease. Facts such as these should convert the most ardent anti-vaccinator from his folly, and convince him that a weapon of defense so powerful as vaccination should not be left to the pleasure of the individual, but that the State has the right and duty to look after its most thorough performance.—*London Times.*

### Improved Secondary Battery.

We learn from the *Metalarbeiter* that a modification of the Planté battery has been constructed by M. De Pezzer, in which a maximum of intensity is combined with a minimum quantity of lead. The negative electrode is a very thin sheet of lead, not exceeding one millimeter in thickness, while the positive plate is not more than two-thirds of a millimeter thick. The projecting portions of the plate which serve for connections are, however, somewhat thicker. Besides, two like pairs were employed, each consisting of two leaden plates of the same thickness, but one of them had twice as large a surface as the other. These pairs were both charged in the same manner, but they were so arranged that in one case the plate with the larger surface served as positive element, and in the other pair it was made the negative element. Repeated experiments made in this way showed that the pair in which the plate with the larger surface formed the negative electrode collected more electricity than the other pair in four consecutive continuances, and that the discharge of the pair with the large negative plates took at least an hour, while in the pair in which the positive plate had the larger surface it only lasted for half an hour.

Finally, what seems more surprising at first sight, in a battery in which both plates were as large as the big plates in the battery just described, the results were not so good as the pair with the large negative and smaller positive plates.

Acting upon these results, De Pezzer changed the construction of his battery as follows: The surface of the positive leaden plate was only made half as large as that of the negative, and at the same time a number of cuts were made in it. The arrangement of the cells was the same as in Planté's secondary battery, but the weight of battery to collect a certain quantity of electricity is less than with the former construction. Ducretet uses plates with indentations made by the rolls.

### RECENT INVENTION.

An improved wheel cultivator has been patented by Mr. Francis O. Williams, of North Cohocton, N. Y. The object of this invention is a sulky or wheel gang cultivator or shovel plow for tilling corn or potatoes, or anything planted in rows. It is light, durable, of easy draught, and can be turned around within small space, and is capable of being easily used upon side hills.

### Antimerulion.

Dr. Zerener has given this classical name to a preparation much used and recommended abroad for preventing mould, mildew, and dry rot. When properly employed it hinders the appearance of dry rot, *merulius destruens*, and serves to destroy it. The substance is made in three forms. The liquid preparation of 30° B. is made of boracic acid, common salt, and silica, and is applied by means of a brush or pencil to woodwork and masonry. In factories where moist fumes and vapors are evolved, which favor the production of mould and fungus, this acts as a protection for the building. The so-called doubly prepared antimerulion consists of infusorial silica, with the addition of 20 per cent of boracic acid; it is to be scattered in moist or damp places. The simple dry antimerulion contains, besides the infusorial earth, only 8 per cent of boracic acid, is less active, and used specially for protecting moist places from mould, for insulating material, and to exclude the atmospheric air and terrestrial warmth—that is for ice cellars, ice chests, water pipes, and heating arrangements. In places where mould and dry rot are feared the dry antimerulion is packed in. It is better to expose these places to the air and paint them thoroughly with the liquid substance and then repeat the application annually. The two first-named substances are furnished by the chemical factory of G. Schallehn, in Magdeburg, at 57 cents per 100 pounds; and the last named, or solid compound, at half this price.

The name, of course, is derived from *merulius*, a kind of dry rot or powder post, against which it claims to be a specific.

### Purification of Naphthaline.

BY PROF. G. LUNGE.

It is well known that the whitest naphthaline turns red by a longer or shorter exposure to the air, and this indicates impurities. The naphthol manufacturers, however, demand a naphthaline which is as pure as possible chemically, and which remains white. The author published in the *Berichte*, of Berlin, a simple method of purification based upon the assumption that reddening of naphthaline was analogous to that of phenol (carbolic acid). The very purest phenol does not turn red, and it is only in the presence of traces of the higher homologues that the redness appears in a longer or shorter time. Therefore the use of an oxidizing agent seemed to be indicated for use in purifying naphthaline, and it led to the desired end in a simple manner.

The crude naphthaline is mostly obtained from the oil that remains after treatment with soda lye for the purpose of separating the phenol. In such oils the treatment with acid can be begun at once, but naphthaline which has been obtained directly from the tar oil by crystallizing it out, should first be treated with alkalies.

The crude naphthaline is melted and a certain quantity of sulphuric acid added to it. On a large scale 5 or 10 per cent of acid, of 66° B., is sufficient; but if acid of 60° is used of course proportionately more is required. When the liquid naphthaline and acid have been well mixed and stirred, 5 per cent of finely ground pyrolusite (binoxide of manganese), or, better still, the regenerated oxide of manganese (from the Weldon process) is gradually added and the mixture heated fifteen or twenty minutes in a water bath. It is then allowed to cool and the cake of naphthaline is washed several times with water, then a little soda is added to the wash water, and then it is again washed in clean water. The naphthaline thus prepared is finally distilled. When purified in this way it has kept perfectly white, according to Lunge, for eight or nine months.

In this country, where the water gas process is so extensively employed, a comparatively pure naphthaline is obtained as a waste product, and if treated as directed by Prof. Lunge would, no doubt, be an excellent material for making naphthol and other derivatives.

### A Theater Smoke Escape.

A Chicago paper describes the recent testing of a smoke escape in use in one of the theaters in that city:

"A number of caldrons, such as the one used by the witches in the cave scene of 'Macbeth,' were loaded up with red and blue fire, and a quantity of combustible material thrown in, creating a dense smoke, sufficient to spread terror throughout any audience. The curtain was lowered until the entire space behind it was enveloped. Then, at a word given, it was lifted, the doors of the auditorium were thrown open, the valve was pulled open, and at once the thick mass of smoke began to pour upward through the aperture. The quantity of smoke which found a way into the auditorium was trifling, and in less than two minutes the stage itself was relieved of what had collected. The experiment was repeated once more, and with still more satisfactory results. A brief explanation will suffice to acquaint the public with its value. An immense funnel rises from the ceiling above the stage to some twenty feet above the roof, and is securely fixed there by a beam running crosswise. At the lower end of this funnel is a valve, which is opened by means of wire pulleys, two extending to the side doors of the stage and one to each of the entrances to the auditorium, the handles being so placed that any one can pull them. In case the stage should be wrapped in flames so that the stage hands could not reach them, the handles at the auditorium doors can be worked. And even should these fail, the woodwork in the valve would be the first to give out. The result would be that a tremendous draught would be created, throwing the volume of smoke and flame up through the funnel, and giving the audience time to escape before the fire began to reach the body of the theater."

### George Jardine.

George Jardine, the well-known builder of church organs, died recently at his residence in this city, at the age of eighty-one. Mr. Jardine was of English birth. He came to this country in 1837, where his brother, John Jardine, had already established himself as a piano manufacturer. The organs built by Mr. Jardine alone, or associated with his sons, are known in every part of the country. Among the larger and finer examples are those in the Fifth Avenue Cathedral, St. George's Church, and the Fifth Avenue Presbyterian Church, of this city; the Brooklyn Tabernacle; and the Mobile and Pittsburg Cathedrals.

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### The Speed and Carrying Capacity of Screw Steamships.

This was the title of a lecture given lately by Mr. William Denny, Dumbarton, under the auspices of the Greenock Philosophical Society. The lecture was delivered before a large audience, in the Greenock Watt Institute, the occasion being the anniversary commemoration of the birth of James Watt, Greenock's great townsman. The results of an elaborate analysis of the Clyde and east coast vessels, with respect to weights and dimensions, were exhibited in a set of tables placed before the audience, the data for which had been supplied to Mr. Denny by various shipbuilders. These showed that the ratio of structural weights to load displacement was greater in the Clyde vessels than in those of the east coast by 18 per cent, thus affording a proportionate advantage in the matter of carrying power to the east coast vessels. In enumerating the causes for this, the lecturer criticised what he considered to be errors on the part of shipowners in determining the proportions of steamers, and of the registration societies in fixing the scantlings. On the latter head, he said that, from a long experience of submitting sections to Lloyd's, he found that the principle upon which they went was that, although a builder might propose an arrangement by which at the same time the weight of a certain portion of the structure was decreased and its rigidity and strength increased, he was required to put the economical weight into some other portion of the structure or to add it to some portion of the rearranged part, the principle being that no builder must be allowed to build a given ship of less weight than his neighbors, even although by the application of his thought and intelligence he could do this not only without disadvantageous results, but with actual advantage. He was not going to blame Lloyd's society or any other registration society for this, because their duties were so delicate in the way of seeing fair play between one builder and another that they were obliged, even at the risk of efficiency, to adopt principles which should secure them from the suspicion of unfairness. Proceeding to speak of the structural character of ships, Mr. Denny said, it at the present moment they desired to see material employed with the greatest economy, and at the same time completely fulfilling its purposes, they must not go to the mercantile marine, but to torpedo boat builders, to the wonderful light structures of the Admiralty, or to the equally light structures produced by private builders free from the control of the registration societies for light draught steamers.

With regard to proportions, the lecturer said that it would be well if owners clearly understood that a steamer of 55 feet moulded breadth must have, as a minimum for efficiency, a moulded draught of about 28, or, if she were to get full justice, say 30 feet; and a steamer of 60 feet beam should have a minimum moulded draught of 30 feet, or better, of 33 feet. That there were some dock proprietors who had received wiser advice upon this point than many shipowners was evidenced by the fact that the new docks which it was proposed to construct at Tilbury, on the Thames, were to have clear draughts of water of 30 feet and upward. Steamers were increasing in size, and the least costly increase for weight-carrying, and up to certain point for speed, was in beam, provided sufficient draught could be obtained. Steamers would follow their natural course of development, and it would be for dock proprietors, river trustees, and harbor boards to see that their docks, rivers, and harbors were of such depth as to permit them to favor steamers so developed. He believed it was found daily more difficult to build the larger types of Atlantic steamers rigid enough for the service even with the great percentage of their displacement devoted to structural weight. A reaction would set in against their extreme proportions and absolute length. When that happened beam would be increased as a consequence, draught increased, and distinct preference accorded to ports having great draughts of water. Besides, the great draught of water and comparative shortness of a steamer were more favorable to the efficiency of the screw, by keeping it well immersed, than an enormous length with shallow draught, which told very much against the screw's efficiency. So important was this matter that the White Star Line tried to overcome the difficulty by a mechanical arrangement. It could only really be overcome by an increased draught of water, and formed thus another argument in its favor.

Detailing his idea of the best form of ships for the future, as exemplified in ships for the great Atlantic trade, Mr. Denny said: "Having secured machinery of the highest possible practical weight for the power to be developed, and, at the same time, of the highest possible present economy, they had to secure a hull of such strength and rigidity as would sustain both the sea strain to which it must be subject and the vibration due to powerful machinery and propellers. They might decide at once that the material to be employed was steel, as being that from which they could obtain the greatest amount of strength and reliability, with the least possible weight. They must, further, decide upon the dimensions of the steamer to be employed, and while, in doing this, supplying a form of little resistance, they must, if possible, supply a form which would make the smallest calls upon them for weights of construction. He had already shown them that extreme actual length was unfavorable to the realization of such wishes. He did not think that either the City of Rome, the Servia, or the Alaska was a type of the future vessel, either for speed or cargo carrying. He was convinced that the steamer which was to do the express Atlantic work would be a vessel of what might be called at the present time moderate length—that was a vessel which would not only be shorter that the City of Rome, but shorter than the Servia, and shorter than the Alaska, which, of the three steamers, so far as he could learn, came nearest the type he had in view. He believed the steamer to do this work would be under 500 feet in length between perpendiculars. What her other dimensions should be would have to be fixed by experiment and a very careful series of calculations and thought.

### American Shipbuilding.

A leading daily paper, having spoken of shipbuilding as a lost art in this country, a correspondent, who speaks with information, denies the charge, and says:

There are at the present time not less than 23,000 American built steamers and sailing vessels engaged in the coastwise, lake, and river trade of the United States. These American built vessels cost from $1,250,000 each downward, according to the service required, the highest priced being engaged in the Long Island Sound and Hudson River service. Some of the coastwise steamers are staunch sea-going vessels of 2,000 tons and upward, equal to any of their size in the world. There are about 167 American built ocean steamers, from 2,000 to 5,000 tons burden, in service between the ports of the United States and England, China, Japan, Australia, and Central and South America. To keep up this fleet of 23,000 American built vessels, and to provide for the increase made necessary by the rapid growth of the country, requires about 5,000 new American built vessels every year. American built sea-going steamers have displaced English steamers between New York and Cuba and Mexico—notably the Alexandre and other lines.

American shipbuilders are competing successfully with English builders even in foreign countries. South America comes to the United States for nearly all its steamers. One firm on the Delaware has built 29 iron and steel steamers for the river Amazon alone, and have the thirtieth at their yard nearly finished. The same firm has built 7 steamers for service on the Orinoco, and some 60 steamers altogether for South America and Mexico, and has 11 vessels now on the stocks and on hand—3 for the United States Government, 1 steel steamer and 1 iron steamer and 6 steel barges for South America. It is also a well-known fact that the governments of England, France, and Russia have recently purchased torpedo boats, steam launches, and vedette boats in the United States.

One more example and I am done. In 1861 our navy consisted of 34 old wooden war steamers, 48 old wooden sailing war vessels, or 82 old wooden vessels altogether. In a little over three years' time it was increased to 836 vessels, of which 63 were ironclads and 102 unarmored cruisers. The owners of our private iron steamship yards contributed a fleet of 165 monitors, ironclads, and unarmored iron cruisers. This was the first ironclad fleet in the world, and was copied by all maritime nations. If need be our builders can again put a fleet of vessels afloat that other nations will be glad to copy.

### The Slate Pencil in Marble Cutting.

An English sculptor says that he has found the slate pencil of great use as an aid and guide in the progress of working a statue in marble.

Its usefulness arises from the fact that the tint of lines and shading made with it on the marble bears extremely close resemblance to that of the shadows produced by actual cuttings, thus, by this means, enabling the sculptor to see the effect of what he proposes to do. In this fashion, tentatively, with the slate pencil he can sketch on his marble in progress the further forms and refinements he would introduce, which afterwards he can carry out, as far as he approves, by following them in actual execution, thereby escaping the peril of a too free use of his chisel in the first instance.

In an oil painting, if an error be made, the color may be altered or removed, and the requisite variation introduced; but marble once cut away cannot be restored, and the deficiency admits of no satisfactory remedy. Therefore, any method which will enable the sculptor to escape this danger by affording him the opportunity of previously testing the effect of what he proposes, without actually cutting it in, may well be thought worthy of consideration.

The forcible markings of lead pencil or black chalk, which are so much more powerful than the shadows of marble, and different in tone, while they are appropriately used by the master sculptor to indicate to his workmen distinctly on the marble what he wants done, are, on that very account, unsuitable to imitate and test the effect of proposed cuttings. Also the markings made with these materials are more permanent than those of slate pencil, and thus also perhaps more fitting for the direction of assistants. But, on the other hand, when the service sought is tentative, then even the easy brushing away of the slate pencil marks is convenient, as they thus may be the more readily altered until the effect desired is obtained. This quality, combined with the special and far more important advantage of the tint of slate pencil on marble so exactly counterfeiting its shadows, may well recommend it to the sculptor in making preliminary tests of the further details he seeks to introduce in his work when it has come into his own hands from those of his assistants. It pioneers and denotes the way for the chisel to advance, and acts like a cautious guide to avert a possible catastrophe; as a heedless, ill-considered, or impatient stroke with the hammer and chisel may at any time during the progress of a statue sadly prejudice its future.

### ENGINEERING INVENTIONS.

Mr. William B. Turman, of Waldron, Ark., has patented an improved slide valve, which consists in the combination with the steam chest provided with supply and exhaust ports, guide straps, and adjustable pack strips, of a valve provided with an entrance port, interior steam chamber, exhaust ports, an opening between the exhaust ports, and projections on its top and one side.

An improved means for connecting and disconnecting cars from their traction rope has been patented by Mr. William Norris, of Cambridge, Ohio. It consists in peculiar means for connecting the cars to the endless traveling cable, and in the means for automatically disconnecting the cars from the cable at the end of the route without the necessity of stopping the engine which drives said cable.

Mr. Reuben Jones, of Mountville, Ga., has patented an improvement in car couplings, which consists of a draw-head pivoted in a draw-bar, and adapted to be raised or lowered by a lever operated from the side of the car to couple cars of different heights, the draw-head of one car, carrying a coupling link, striking the draw-head of the car to be coupled and forcing back a slide supporting a coupling pin until the hole in the slide registers with the hole in the draw-head, and the coupling pin falls by gravity through the link, coupling the cars.

### The Improvement of the Mississippi River.

In a voluminous report the Mississippi Commission describe a plan by which they believe the low river channelway, from Cairo to the mouth of the river, can be narrowed to an approximately uniform width of 3 000 feet, by revetments and dikes, and declares that this plan will establish and maintain a continuous low river channel not less than ten feet deep.

Proceeding upon the assumption that the work from Cairo to Vicksburg will cost one fourth of the whole, the commission estimates that the cost of the entire improvement will be $33,000,000. One member does not regard this estimate as sufficient. The commission then estimates that $4,128,000 will be required for continuing the work in the next fiscal year. This is for that part of the river below Cairo.

The members of the commission do not agree as to the utility of levees as a means of deepening the channel or improving navigation. Levees have never been erected on the banks of the river except for the special purpose of protecting the lands from overflow. The commission has caused eighty-three borings to be made in the course of the bed of the river, in order to ascertain whether the bed consists of layers of tenacious blue clay, belonging to the tertiary formation, and is, therefore, of a practically permanent character. Most of the borings were more than 100 feet in depth, and some exceeded 200 feet, but in only twenty-two cases were the alluvial strata pierced and the underlying tertiary beds reached. The mean depth of the alluvial beds is 131 feet below high water, and the underlying layers are of clay and sand, with beds of lignite. They would not offer great resistance to erosion, if it should become necessary to reach them, for the clays contain much sand. The commission does not expect that in any part of the stream it will be necessary to disturb these lower layers.

### How to Apply the Soda Remedy in Burns and Scalds.

It is now many years ago (see the *London Medical Gazette* of March, 1844) that the author of this paper, while engaged in some investigations as to the qualities and effects of the alkalies in inflammations of the skin, etc., was fortunate enough to discover that a saline lotion, or *saturated* solution of the bicarbonated soda in either plain water or camphorated water, if applied speedily, or as soon as possible, to a burned or scalded part, was most effectual in immediately relieving the acute burning pain; and when the burn was only superficial, or not severe, removing all pain in the course of a very short time; having also the very great advantage of cleanliness, and, if applied at once, of preventing the usual consequences—a painful blistering of the skin, separation of the epidermis, and perhaps more or less of suppuration.

For this purpose, all that is necessary is to cut a piece of lint, or old soft rag, or even thick blotting paper, of a size sufficient to cover the burned or scalded parts, and to keep it constantly well wetted with the sodaic lotion so as to prevent its drying. By this means, it usually happens that all pain ceases in from a quarter to half an hour, or even in much less time.

When the main part of a limb, such as the hand and forearm or the foot and leg, has been burned, it is best, when practicable, to plunge the part at once into a jug, or pail, or other convenient vessel filled with the soda lotion, and keep it there until the pain subsides; or the limb may be swathed or encircled with a surgeon's cotton bandage previously soaked in the *saturated* solution, and kept constantly wetted with it, the relief being usually immediate, provided the solution be saturated and cold.

What is now usually sold as bicarbonate of soda is what I have commonly used and recommended; although this is well known to vary much in quality according to where it is manufactured—but it will be found to answer the purpose, although probably Howard's is most to be depended on, the common carbonate being too caustic. It is believed that a large proportion of medical practitioners are still unaware of the remarkable qualities of this easily applied remedy, which recommends itself for obvious reasons.—*F. Peppercorne, in Popular Science Monthly.*

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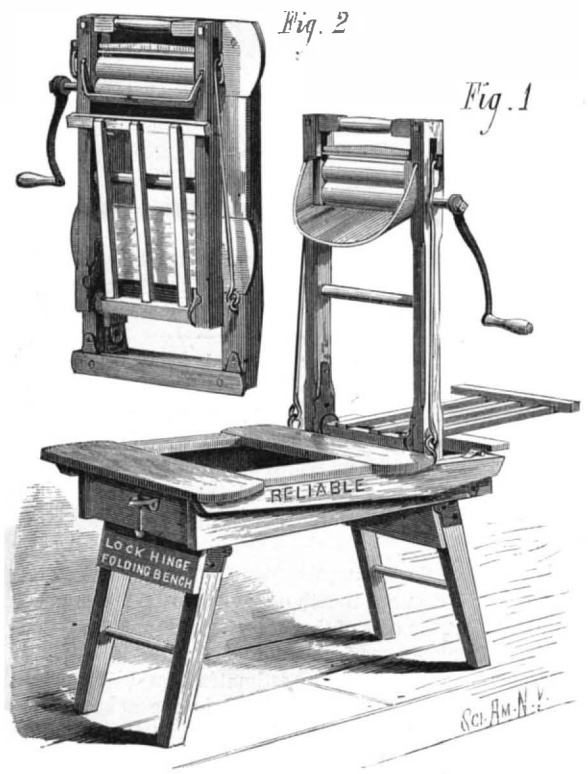
### IMPROVEMENT IN WRINGERS.

The engraving represents a novel arrangement of clothes wringer and bench, recently patented by Mr. James K. Dugdale, of Richmond, Ind. In this device the weight of the tub and its contents are utilized for creating pressure between the two rollers of the wringer. The rollers are journaled in vertical posts hinged to the bench frame, and the cross bar which bears upon the movable journal boxes of the upper roll is connected by rods with levers hinged to opposite sides of the bench. Upon the top of these levers there is a platform adapted to receive a tub or other receptacle for clothes and water.




DUGDALE'S IMPROVED WRINGER.

The hinges by which the levers are connected with the frame are made adjustable, so that any desired degree of pressure may be brought to bear upon the clothes between the rolls. The forward end of the platform is guided by a pin working in a slotted plate projecting from the end of the bench. At the opposite end of the bench there is a folding rack for supporting a clothes-basket for receiving the goods as they are passed through the rolls. This rack is capable of being extended or contracted to suit circumstances. The rolls are provided with an inclined apron or water trough which returns all of the water to the tub and prevents slopping. The machine is well calculated for practical use, and is capable of being folded compactly, as shown in Fig. 2, for storage or shipment.

### IMPROVED FIRE-EXTINGUISHING APPARATUS.

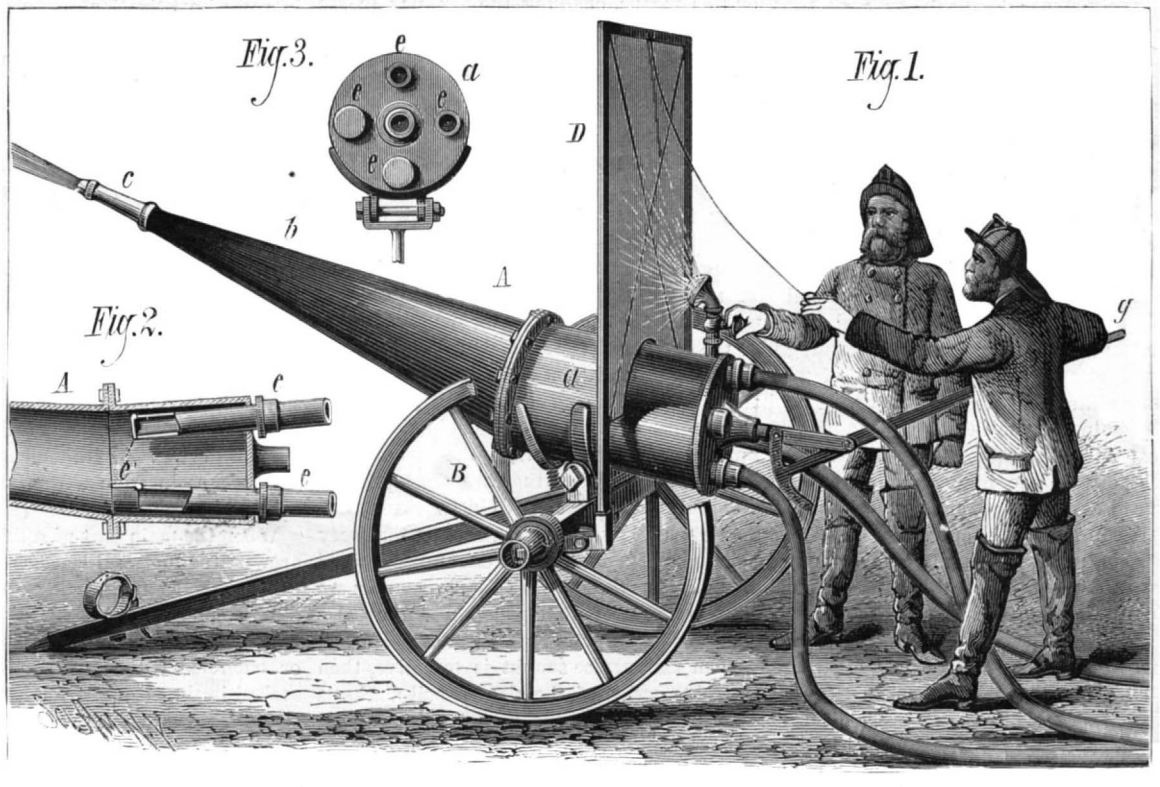
We give an engraving of a fire-extinguisher adapted to receive one or more streams from hydrants or steam fire engines, and to discharge the water in a single solid stream, which is found to be much more effective and capable of reaching through greater distances than the several streams used separately.

The nozzle, A, consists of three portions—the butt, *a*, barrel, *b*, and tip, *c*. The nozzle is screwed to the barrel, so that it can be removed or exchanged for a larger or smaller one. The butt is fitted at its end with a number of screw nipples or tubes, *e*, for connection of the hose pipes. Within the butt, valves, *e'*, are fitted to close over the apertures by internal pressure, so that water cannot escape by the nipples not in use. The butt is also formed with a socket that receives the end of a lever or handle, *g*, by which the nozzle is manipulated.

The nozzle is mounted on a truck, and a forward truck is provided for supporting the forward end of the nozzle. This truck is fitted with a short reach having a socket in its end for receiving a long reach attached to the main truck. In going to and from the place of use the forward truck will be used, and for that purpose a draught pole and a driver's seat are fitted on the truck. When the fire is reached the forward truck is to be removed, the manipulating lever is put in place, and two or more lines of hose are connected to the nipples, and the device is aimed by manipulation of the handle, and a solid stream combining the smaller streams is discharged at one point.

To protect the operators the truck is provided with a shield or screen, D, consisting of a frame covered with canvas and strengthened by rope or wire braces. The side bars of the frame are hinged or jointed, so that the shield can be folded compactly when not in use. A hose pipe with a spray nozzle is connected with the nozzle to keep the shield wet. These arrangements allow the firemen to approach closely to the fire with the nozzle.

This invention was recently patented by Mr. Daniel B. Lynch, of Grass Valley, Cal.




LYNCH'S FIRE-EXTINGUISHING APPARATUS.

### MISCELLANEOUS INVENTIONS.

An improvement in electric lamps, patented by Mr. Ludwig K. Böhm, of New York city, relates to electric lamps of the arc type, in which the carbons are contained in vacuum chambers of glass. The object of this invention is to provide for convenient renewal of the carbon and insure uniform feed of the positive carbon to compensate for waste, to which ends the invention consists in a carbon holder of novel construction, combined with a separable vacuum chamber. The same inventor has also patented an improvement in electric lamps of the class in which an incandescing carbon is employed in a vacuum chamber, the object being to allow the use of straight carbons and to facilitate the introduction of the carbons and sealing of the wires.

An improved electric lamp has been patented by Mr. Edwin M. Fox, of New York city. This improvement relates to electric lamps of that kind which give light by the incandescence of a piece of carbon contained in the vacuum chamber.

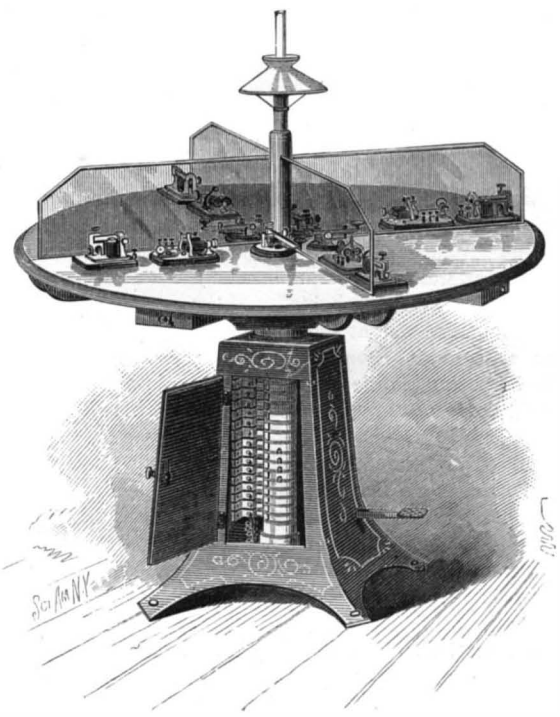
Mr. Lambert F. Fouts, of Greenfield, Iowa, has patented an improved switch board for use in connection with annunciator or burglar alarms. The several doors and windows of a dwelling, hotel, or other structure, or any other desired points, are connected in a closed circuit with a battery, an alarm, and the switch board, the latter having a pivoted button and fixed post for each door or point in the circuit. When a "break" is made—as, for instance, when a door is opened—it may be located by moving one or more of said buttons until the restoration of the circuit through branch wires connected with the aforesaid posts and the consequent arrest of the alarm give the required indications.

Messrs. Josiah Austin and Rossco Chamberlain, of East Liberty, Ohio, have patented a gate which can be opened and closed by the vehicle which passes through it without compelling the driver to alight. It is an improvement upon that form of automatic gate in which a toothed bar acts upon a set of segmental teeth connected with the gate post to open or close the gate by the longitudinal movement of the sliding toothed bar, which is actuated by rods on opposite sides of the gate connected with double-cranked shafts that are struck and deflected by the vehicle wheels.

An improved axle-box cover has been patented by Mr. Daniel A. Bolt, of Stillwater, Minn. The object of this invention is to provide an efficient, easily-operated, and cheaply constructed lid or cover for the axle boxes of railroad and similar trucks, and one having such construction and arrangement that it will close from the jar or motion of the truck if accidentally left open. The invention consists of side pieces or facings, which are cast with or secured upon the face of the box, formed with the grooves or ways in which the cover or lid moves, and with projections at their upper ends for limiting the upward movement of the cover or lid, in combination with the lid formed with a bar or rod across its lower end, the sides of the lid being formed with cams or wedge-shaped projections to correspond with similar projections formed in the grooves or ways to hold the lid tightly in place when closed and to prevent all rattling of the lid when the cars are in motion.

### REVOLVING TELEGRAPH TABLE.

The engraving shows an improved revolving telegraph table patented by Mr. John L. Garber, of Greenville, Ohio. The table is divided by glass partitions into a series of subdivisions for the several sets of instruments. Each compartment of the table requires four strips or rings of metal around the central post, a separate insulated wire leading




GARBER'S REVOLVING TELEGRAPH TABLE.

from each ring to their respective instruments on the table, the wires being placed in a shallow groove directly back of the rings and metal collar. The central post revolves in the central hollow leg of the table, and the hollow leg is provided with a series of contact springs, consisting of a segmental plate attached to a countersunk stem fitting into a socket and pressed against the plates or rings of the central post by a spiral spring, these contact springs or their sockets are connected with the local battery or main line: To the under side of the table is fastened a perforated ring, into the aperture of which a vertical locking bar fits, which is pressed upward by a suitable spring, and can be withdrawn by depressing a foot lever on the under side of the base frame of the table.

For conveniently illuminating the different sections of the table a lamp or gas burner is mounted at the intersection of the glass partition of the table When the operator wishes to use any certain set of instruments he depresses the foot lever, which permits the table to be turned until the desired set of instruments is in front of the operator, who does not leave his seat. The foot lever being released the table is locked in position. This table may be arranged for two, three, or more sets of instruments, the number of rings and contact springs varying accordingly.

The advantages of this device will be apparent to telegraphic engineers and operators. The removal or insertion of switch plugs or the turning of switches is entirely avoided, the necessary changes being made automatically as the table is turned.

### A Six-legged Cow.

A cow with two extra and useless legs was shown in Washington Market the other day. She came from Colorado, where she was found in a herd of cattle on the plains. The extra legs grew from the shoulders and were shaped like hind legs. The leg on the right side, terminating in an elongated hoof, measured 26 inches, and was at least 20 inches from the ground. The leg on the left side measured 16 inches, and was about 30 inches from the ground and evidently undeveloped. Looking from the tail of the animal toward the head the spine assumed a zigzag line, and the buttocks were widely separated, while the hips were unusually prominent.

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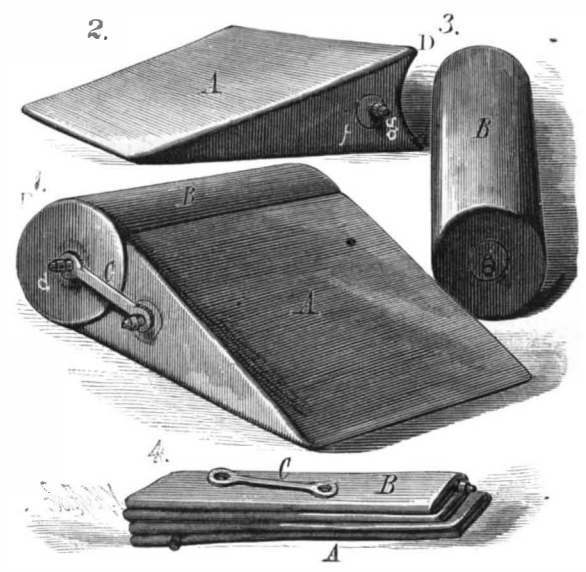
### NOVEL PASSENGER HEAD REST.

We give an engraving of an improved passenger head rest lately patented by Mr. Ernest Scharpe, of New Orleans, La. The cylindrical tube or pillow, B, has closed ends, B B, each having a central projection, one of which is made hollow and provided with an air-tight cap, *d*. The lower section, A, is made wedge-shaped, with top portion, D, concaved throughout its whole length to fit snugly against the upper section. The length of the two sections are about equal, and the lower, like the upper one, is provided with end projections or pipes, *f*, for the introduction of air, which is prevented from escaping by air-tight caps, *g*. The two sections are connected together by means of links, as shown in Fig. 1; the links being so constructed as to permit the free rotation of the cylindrical pillow on its end projections or axes. The two sections connected in this way are arranged in a vertical or inclined position against the back of a car seat in such a way that the cylindrical tube or pillow, B, receives the head in its resting position, while the wedge-shaped section will conform to the back. The concaved portion of the section, A, will prevent the cylindrical pillow, B, from descending, and at the same time retain its position.




SCHARPE'S PASSENGER HEAD REST.

This rest, because of its elasticity, adjusts itself to the curves of the head, neck, and trunk, affording a means of rest in a partially upright position, and the peculiar connection between the two sections admits of revolving the cylindrical pillow to present a cool surface to the head of the user when desired.

When not in use the sections are disconnected and the air is expelled from each, thus forming a small package which can be carried in the pocket or made to occupy but a small space in a valise or other receptacle.

### THE FORCE OF A CROCODILE'S JAW.

Some unique experiments have lately been made in France, on the strength of the masseter muscles of the crocodile (a muscle passing from the cheek bone to the lower jaw). M. Paul Bert received ten gigantic crocodiles (*Crocodilus galeatus*) from Saigon, which were transported alive to France in enormous cages weighing over 3,000 kilogrammes. Some of these crocodiles measured ten feet, and weighed about 154 lb.

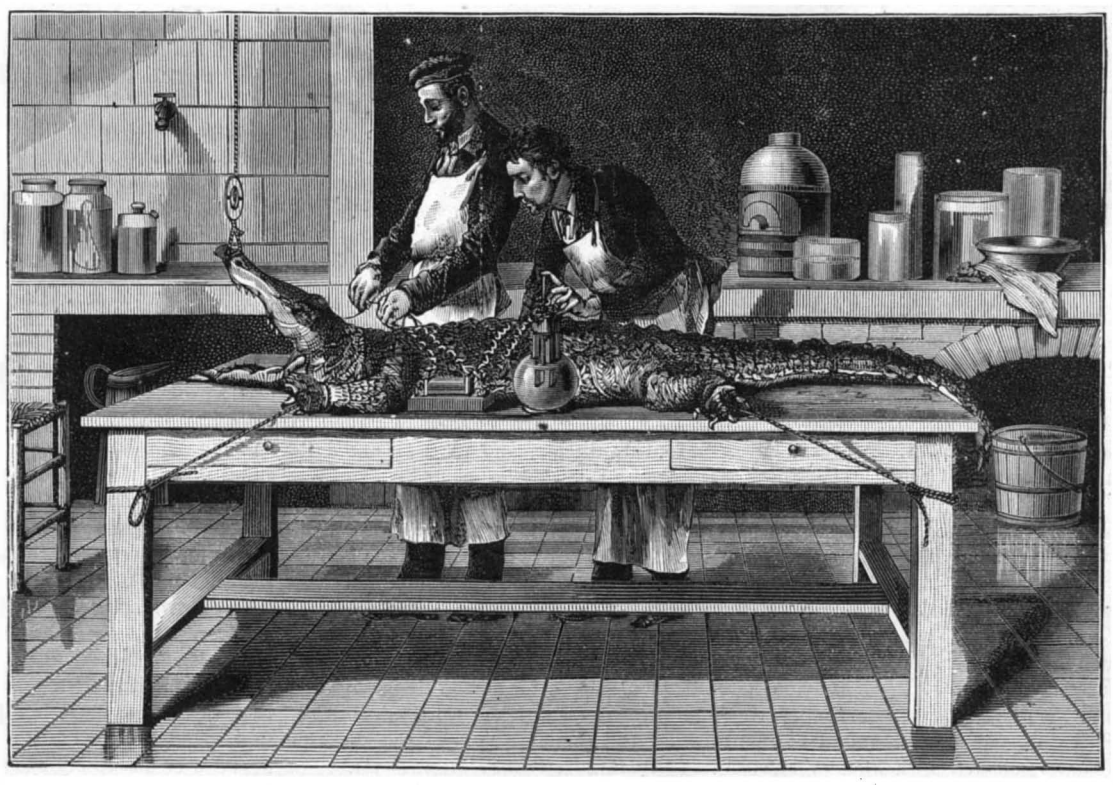
The reader can easily understand how difficult it must be to manage such ferocious animals in a laboratory; and it was only by the assistance of the managers of the Zoological Gardens that this dangerous task was accomplished.

In order to measure the strength of the masseter muscle of the crocodile's jaw the animal was firmly fastened to a table attached to the floor; the lower jaw was fixed immovably by cords to the table; the upper jaw was then attached to a cord, fastened by a screw ring to a beam in the roof. There was a dynamometer placed on this cord, so that when the animal was irritated or given an electric shock, the upper jaw pulled on the cord, and registered the force of its movement on the dynamometer.

With a crocodile weighing 120 lb. the force obtained was about 308 lb. avoirdupois. This does not equal the actual strength, for as the dynamometer is necessarily placed at the end of the snout, it is really at the end of a long lever, and must be measured by finding the distance between the jaw muscle and the end of the jaw, to show the real force of the jaw muscles, which equals 1,540 lb. As this experiment was performed on a crocodile already weakened by cold and fatigue, its force when in its natural conditions of life must be enormous.

This power of 308 lb. represents a power applied over the whole surface of the crocodile's mouth. In reality it is first used by the enormous teeth that overlap the others in the front of the jaw, and by a simple calculation the pressure of these teeth is estimated to be equal to the pressure of 400 atmospheres. The power of the crocodile's jaw was compared with that of an ordinary dog weighing about 44 lb., whose jaw was measured in the same way. A force of 72 lb. was obtained, which, when multiplied like the crocodile's, was found to equal the pressure of 100 atmospheres.

In comparing the weight to the jaw force of these two animals it is found that a crocodile is one-third stronger, weight for weight, than a dog.—*La Nature.*



EXPERIMENT TO DETERMINE THE POWER OF A CROCODILE'S JAW.

### Pole Roads.

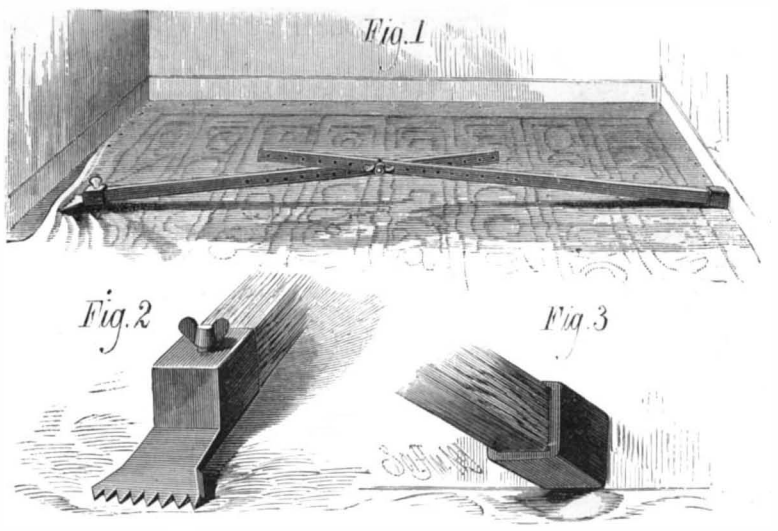
Pole roads for logging purposes are, says the *Northwestern Lumberman*, the simplest among the many forms of road which lumbermen find convenient and necessary in the prosecution of logging operations, when snow and ice roads are not available. They can be constructed in any locality where the ground is reasonably level, and are particularly adapted to such locations as present a sandy or fairly firm soil. They consist of long, small peeled poles, the longer the better, from four to five inches in diameter at the top, to eight or ten inches at the butt end. The more evenly they carry their size from butt to top, the better the road. The ends of the butts, and as well of the tops, are long scarfed, and pinned together with suitable hard wood or strong pins, of one and a half or two inches in diameter, according to the size of the timber through which they are to be driven. Tops should be scarfed to tops, and butts to butts, in order to provide a perfect bedding of all parts in the ground. If the scarfing is done so as to cause the poles to lie naturally on the ground when in place, the pins should be long enough to penetrate the earth to some distance. This is all the fastening or anchoring usually provided.

The wheels of the car are concave or V-shaped, and as they pass over the rails naturally force them to maintain their proper distances from each other, while preventing them from spreading apart. It will take but a few trips of a loaded car over these poles to bed them in the earth, when spreading is practically out of the question. The wheels must, in their concave surface, be adapted to the general size of the poles to be used, and if larger poles are employed, or large butts are used, the ax must be used in hewing off enough of the surplus wood to give the wheels a sure bearing. Any kind of timber which carries its size well may be employed, and if a pole gives out it is easily replaced. But comparatively little grading is requisite, although it is obvious that the more level the top of the track is kept, the less friction is encountered; for this reason it is well to bed the butts enough to bring them level with the bedded tops. No cross-tying is employed, and so solid are these roads that, in many sections, light locomotives are run upon them. With these general points stated, any man who comprehends the conditions under which concave wheels may be kept from running off through mounting the poles should have no difficulty in building a pole road. If the soil is not sufficiently firm to prevent the poles from becoming too deeply embedded, cross-ties of poles may be used, but as a rule they are more harm than advantage, as they tend to prevent the self-adjustment of the track for which the concave wheels would naturally provide.

### IMPROVED CARPET STRETCHER.

The engraving represents a simple and effective carpet stretcher recently patented by Mr. Michael Winter, Sr., of Union City, Ind. It consists of two bars of wood pierced with holes at short intervals throughout one-half their length, and pivoted upon a bolt having a wing nut by which the two bars may be clamped together.

One of the bars is provided with a toothed plate at its free end to be inserted into the fabric of the carpet, the other bar has a cushion upon its free end, to be placed against the base board on the side of the room opposite that toward which the carpet is stretched. The holes are near enough to each other to admit of adapting the stretcher to a room of any size by changing the bolt from one set of holes to another.




WINTER'S CARPET STRETCHER.

The operation of the stretcher is very simple; the cushioned end of the device is placed against the base-board, and while the two bars are at an angle with each other the toothed plate is inserted in the carpet near the edge to be carried toward the wall; the angle formed by the bars is now flattened until the carpet is sufficiently stretched. If the bars are depressed so that they are parallel to each other they will remain in position without locking; but if the bars remain at an angle it will be necessary to clamp them together by means of the bolt.

The advantage of this stretcher over those in common use will be apparent to any one having had experience in putting down carpets. It stretches the carpet throughout its entire width, and requires very little exertion to put any desired amount of strain on the carpet.

### MECHANICAL INVENTIONS.

A machine for sawing lumber or boards into certain standard lengths known in the trade as, for example, "twelve-foot" lengths, "fourteen-foot" lengths, or lengths denominated by the number of feet, has been patented by Mr. Willard B. Swartwout, of Three Rivers, Mich. The invention consists in a novel combination of certain devices, whereby provision is made for automatically feeding the lumber to the saws and adjusting the saws so as to cause them to cut the lumber in the desired lengths.

Mr. Henry H. Norrington, of West Bay City, Mich., has patented an improvement in the class of punches or perforating stamps designed for use in banking and other similar establishments for the purpose of puncturing or cutting out portions of a check or other written instrument, and thereby preventing fraud by alteration of such instrument to cause it to express a higher value than was originally intended.

Mr. Martin W. Speulda, of Springfield, Ill., has patented an improvement in fare registers of that class which are to be carried by the conductor, and operated as each fare is received to register the number of fares taken. This register has a pull bar which gives a step-by-step movement to a train of wheels bearing numbered dials, and simultaneously rings a bell at each movement.

Mr. Samuel C. Robinson, of Pemberton, O., has patented a ditching machine which is an improvement on a ditching machine for which Letters Patent were granted to the same

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inventor June 28, 1881, No. 243,624; and it consists, first, in entirely inclosing both sides of the ditching wheel with suitable plates, to prevent the ingress of dirt into the wheel, and dishing said plates from the rim of the ditching wheel to its center, whereby the thickness of the ditching wheel is greatest at its rim, and the side plates will not interfere with the sides of the ditch in excavating it.

A novel device for dressing saw teeth has been patented by Mr. Edmund Holderman, of Liberty Mills, Ind. The object of this invention is to give uniform set to saw teeth after having been set and filed. The invention consists in a bar of metal having set screws and an adjustable guard for gauging the degree of set in saw teeth, and suitable clamping devices for holding a reversible file at any desired angle of inclination.

An improved cloth-cutting machine has been patented by Mr. Nathan B. Rafelson, of New York city. This invention consists in a press cutter frame provided with rollers which move upon a track along the sides of a table of any desired length and a combination of cutting blades, by which an entire pattern may be cut by a single operation. The invention further consists in an arrangement of spiral springs for preventing the cloth from being disarranged by the withdrawal of the knives

Mr. James H. Peters, of Nechesville, Texas, has patented an improvement in cloth-measuring reels, designed principally for measuring bagging, carpets, etc. The invention consists in the peculiar combination and arrangement of the cutting board with two standards, whereby the cutting board is made to act as a sufficient brace for the frame as well as to perform the offices of a cutting board.

Mr. John A. Quick, of Palestine, Texas, has patented a spring tensioned sash balance by which the top sash may be held in close contact with the top of the window frame or adjusted at a lowered position without hoisting the bottom sash.

## HOW DWELLING HOUSES ARE POISONED.

A timely and important meeting of the New York Academy of Medicine was held the other evening to consider certain domestic causes of disease and death. The paper of the evening was by Mr. Charles F. Wingate, on "Practical Points in Plumbing," and the unsanitary condition of most city houses was discussed by Dr. Fordyce Barker, Dr. Willard Parker, Professor Doremus, and others. Introducing the essayist, Dr. Barker spoke at considerable length upon the very general prevalence of disease traceable to bad plumbing, and of the frequent loss of life in consequence of defective pipes and the absence of traps in sewer connections.

Mr. Wingate described some of the more common and disastrous defects in plumbing and the means for detecting and correcting them.

### HOW AND WHERE TO LOOK FOR DEFECTIVE PLUMBING.

"The first point," he said, "is how to examine a house. Every part of the plumbing must be exposed to view or tested, and things are usually found different from what they have been represented. The peppermint test is one of the first. An ounce of oil of peppermint in a pail of water is poured into the openings of the plumbing fixtures at the upper part of the house. If the smell of peppermint escapes by a leak this shows that sewer gas would also escape. A second point is the quality of the details of the plumbing work. A single portion of the work, one joint of a pipe, will tell a practiced plumber the capacity of the workman. If a house is deficient in its minor details, it will be found generally bad. A direct leak from a pipe will be shown by holding a candle near it. The practiced nose can tell a leak in a short time, and by the density of the smell from a roof pipe it can be learned whether there is a trap in the pipe to the sewer. The sanitary engineer goes first to the cellar and looks at the sources of damp. These are manifold both in the city and country; rain and snow blow in; there is leakage from the water pipes and areas, and there is the refrigerator waste. I visited a house in Boston where all the rain water and refrigerator waste were soaking into the soil, and the house, in addition, was on low made-ground on the Back Bay. I saw here a novel phenomenon; the ground was so damp that the whole of the yard was covered with a fine moss. Dangerous as this dampness was, it was hard to convince the occupant, because there had been no sickness in the house, and the owner considered me an impostor.

"Another source of danger is from broken or leaky underground drains. Most houses have underground drains which are made of tiles laid by ignorant workmen, and I have seldom or never found a drain which was not in a defective condition. Even in Memphis the new drains were not absolutely tight, on account of the extra pitch in some cases, and of breaks. Then the soil becomes saturated with the worst kind of sewage. In Boston I have found many drain pipes without the proper pitch or flush. Some pitched toward the houses instead of the sewers; others were choked with grease, or there were no sewer connections at all. The plumber sometimes ran the drain over a rock, up and down, or ended it on one side, continuing on the other, or connected two sections of six-inch pipe by a four-inch pipe. A break or stoppage means such a deadly deposit of sewage as accumulated under a house I examined near Murray Hill. It was taken by a family last spring, who, in a few months, nearly all fell sick. The gentleman said that on opening the register in his bedroom he was almost choked by a peculiar ammoniacal smell. Nothing but iron pipes with lead joints properly coupled, and carried along the cellars in sight, or in trenches easily accessible, should be used."

### SOURCES OF SEWAGE POISON.

After mentioning the risks arising from undrained made land and lands lying near the water level, Mr. Wingate traced the history of plumbing evils in New York city from the introduction of Croton water and the necessary development of the sewer system. In 1849 there were only 72 miles of sewers in New York; now there are 341 miles. Many of the first sewers were only sewers in name, having been laid to carry off kitchen waste alone. They were merely rough stone drains uncemented and open, so that when used to receive sewage they rapidly polluted the soil, and became simple store-houses of sewage. Down to a very late date many of the sewers of New York were constructed of inferior material and imperfectly laid. Badly burned bricks, bogus cement, and sand that was half loam were used in making them, while, especially under Ring rule, the contractors who laid them executed their work in the cheapest and most culpable manner. Few of the best sewers are really tight, while the majority leak at every joint, and thus the whole system is an enormous source of soil pollution.

### HOW FOUL AIR PASSES THROUGH WALLS.

Mr. Wingate's paper was followed by a number of experimental illustrations of the permeability of brick and stone by these obtrusive and poisonous gases, and of the ease with which some gases pass through water. The experiments were made by Dr. Doremus, who said, "What must we do, if we have these gases in our sewers? If these are cut off from our houses by water traps, it does no good; the gases will pass through the water. We must have chemicals in the trap that will decompose the gases. Chlorine is the great agent, the 'ring breaker,' that will decompose hydrogen gas and every form of poison. Suppose there is a case of scarlet fever in a house, and the walls become impregnated with the poison. Chlorine or some other gas should be generated that will decompose the poison on the wall. In 1865 the ship Atlanta arrived at this port with a number of cholera patients. Sixty of her passengers had already died. At the request of the Health Physician of the city, and by the authority of Mayor Gunther and Dr. Swinburne, the Health Officer, the Atlanta and all other vessels entering the Narrows were treated with chlorine. bromine, and other active agents. This was so effective that not a single case of cholera occurred in New York or its vicinity.

"Dr. Agnew has informed me that about thirty years ago the north wing of the old New York Hospital became unfit for use in consequence of its walls having become saturated with disease through the reception of a large number of ship-fever patients. Ventilation was tried, but in vain. The walls were scraped, but many of the workmen sickened, and one at least died. At the Lincoln County Hospital, in England, the walls became magazines of disease in the same way. They were gutted and replastered, but it did no good. They then were treated according to the Hebraic system, and torn down to the very foundation. A few years ago certain wards in Bellevue Hospital were found impure, causing pyæmia. At the request of the Commissioners of Charity and Correction I attempted to purify them by the use of chlorine gas. I generated nearly three tons of this in these wards during many weeks. Every few months now the chlorine treatment, in a less vigorous form, is employed.

"Dr. James R. Wood stated, three years after the commencement of this treatment, that no case of pyæmia had originated in the wards since it had been adopted. I think we are warranted in saying that, owing to the porous character of all walls and the decomposing power of certain gases, we can purify not only the walls but the very stones of any edifice, if only the treatment is heroic."

Dr. Willard Parker recited the experience of the physicians at Bellevue Hospital when the ship fever prevailed in 1846. The death rate was fearful, yet the hospital became so crowded that many patients had to be treated in tents under the trees in the yard. Nearly all the unhoused patients recovered. Similarly, when a ship load of infected people were driven ashore at Perth Amboy, though nearly every case on shipboard resulted in death, not one of the sick exposed to the weather, under canvas shelters, failed to recover. It was a foul-air disease, and fresh air cured it. Dr. Parker added:

"We are living in the wrong kind of buildings, and everything is wrong. Previous to the introduction of Croton water in this city, I don't remember a single case of diphtheria. There were numerous cases of croup, and some which resembled diphtheria, now and then. It is a disease which depends on malaria, or bad air. It attacks families and goes through all the members. I had a friend, a physician, who depended on his cellar for all the air for his furnace. His six children were all stricken with this disease. and all of them died. And there are cases of that description everywhere. I say that if we have diphtheria, there is something wrong about our sewers. If I were to build a house, I would not have it connected in any way with a sewer. I should construct a sort of annex, where I should have all the sewers, closets, and all the pipes of the houses. I suppose most of you would object to having a vault filled with dead bodies a few yards from your house, and connected with it by a pipe. Yet this is practically what we do with our sewers. Water is no protection from them—from the germs of poison which generate and live in the foul air."

Pertinent remarks were also made by Drs. Vanderpoel and Janeway. Speaking of the portability of diphtheritic poison, the latter mentioned a remarkable case in his own practice. A child had died from diphtheria in a fine house in Brooklyn, and the parents with two others went South. At Pilatka, the trunks were unpacked, and there was taken out for a child a toy rabbit which the dead child had used for a plaything. In three days the child was taken with diphtheria, of which there were no other cases there, and in five days was dead; and the other child, a few weeks later, succumbed to the disease at a place in the interior of Florida where diphtheria had been unknown. The germs were conveyed by the rabbit and in clothing.

## Engineers' Club of Philadelphia.

At the meeting, February 4, Mr. William A. Cooper presented a description of the progress in methods and contrivances for uniting the ends of rails—a subject of much thought among engineers, as the hundreds of patent fish-plates, chairs, nut locks, etc., show. From wooden rails spiked to sleepers embedded in the ground, an advance was made, about 1765, to iron straps nailed upon the wood to diminish wear. In 1767, at the Colebrookdale, England, Iron Works, cast iron rails 4 inches wide by 1¾ inches thick by 5 feet long, were laid. In 1789 cast iron rails are said to have been set and bolted in cast iron chairs fastened to sleepers, and, in England, the general method of wedging or bolting the rails to chairs fastened to the ties, has continued to be the general practice.

In early American railroading, the strap rail of "snake-head" celebrity was used for economical reasons, but soon abandoned for the T-rail. In 1847 the fish-plate or splice bar, which has superseded in this country all other means of fastening, was designed. It consisted of a pair of plates, 18 inches by 3 inches by three-quarters inch, bolted over joint by four bolts, two to each rail, with oval bolt holes to admit of expansion and contraction in the rail. A later improvement was the use of angle plates, giving greater support to rail and larger bearing surface, and admitting the spike slot in the plate, instead of the rail, to prevent creeping.

The secretary presented, on behalf of Mr. Howard Constable, a description of pneumatic pulverizer, which consists, in brief, of a chamber into which are introduced two injector nozzles, opposite each other, and each connected with a funnel for the reception of the material to be pulverized. By the expulsion of superheated steam through the injectors, the material, previously crushed to about the size of a pea, is forced into collision in the chamber, and about 95 per cent thereof is thereby reduced to fine dust and carried by the exhaust into a settling chamber, the tailings being collected in the bottom of the chamber and returned to the funnels. By a 20 horse boiler, 120 pounds pressure, 1¼ tons per hour have been pulverized, and it is expected to increase this to 2 tons per hour by a pressure of 200 pounds, and take the place of a 20 stamp mill which weighs about 4,000 pounds, while this machine proper weighs about 100 pounds only. Specimens of quartz, in crushed fragments and powder, were submitted—the latter being almost entirely composed of an impalpable dust. It is designed to make use of this machine for pulverization in general.

## Action of Hydraulic Cements upon Embedded Metals.

John C. Trautwine, C.E., in a communication to the *Railroad Gazette*, dated Philadelphia, January 21, 1882, says:

"The fact that this important subject has of late been brought somewhat prominently before the notice of civil engineers and builders induces me to send you the results of ten years' trial by myself. The hydraulic cements used were English, Portland, and Louisville (Kentucky), besides which I tried plaster of Paris, both pure and mixed. with equal measures of the cements. All were of about the consistency of common mortar; and all were kept in an upper room during the ten years, unexposed to moisture other than that of the indoor atmosphere.

"The metals were partly embedded in the pastes and partly projecting from them. They consisted of cut iron nails (some of which were galvanized), smooth iron wire nails, brass in both sheet and wire, zinc in sheet, copper wire, and solid cylinders of lead, three-eighths inch diameter.

"The result at the end of ten years was that all the metals in both of the *neat* cements were *absolutely unchanged;* and the same was the case with those in the plaster of Paris, with the exception of the *ungalvanized* nails, which had become covered with a thin coat of rust: as were also those in the mixtures of plaster and cement, but to a less degree.

"This experience leads to the inference (already suggested by others) that moisture or dampness is the injurious agent in those cases of corrosion of iron and lead laid in cement that have lately appeared in the journals; and that if dampness can be absolutely excluded, both cement and lime mortar will probably protect from injury all the metals employed in ordinary constructions, for an indefinite time.

"Such entire exclusion of dampness may at times be somewhat difficult of attainment; for capillary attraction *alone* (unaided by hydrostatic pressure) will cause water to rise several inches in well-hardened cement; and it would be difficult to assign limits to its penetration when aided by a high head of water. Rain water is well known to percolate through many feet in depth of brickwork or masonry laid in lime mortar, even when it consists partly of cement."

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### How Aluminum is Obtained.

A mixture of ground aluminous clay (ordinary clay, but of a good quality) and soda ash (carbonate of sodium) are heated in a furnace, aluminate of soda and silico-aluminate of soda being formed. The fused mass is then broken into pieces and thrown into an iron tank containing water; the mass is frequently stirred, and finally allowed to settle.

The aluminate of soda (being soluble in water) is dissolved, while the silico-aluminate of soda (being insoluble in water) sinks to the bottom of the tank, with any peroxide of iron that may be present in the clay.

The liquid is then drawn off, and carbonic acid gas passed through the solution. This decomposes the aluminate of soda, forming carbonate of soda and pure alumina hydrate. Thus:

$$\underbrace{2AlNaO_2}_{\text{Aluminate of Soda.}} + \underbrace{CO_2}_{\text{Carbonic Acid Gas.}} + \underbrace{3H_2O}_{\text{Water.}} = \underbrace{Na_2CO_3}_{\text{Carbonate of Soda.}} + \underbrace{2Al(OH)_3}_{\text{Alumina Hydrate.}}$$

The alumina hydrate is then dried, mixed with chloride of sodium (common salt), and charcoal or coke, and formed into balls about the size of an orange. These balls are then taken and put into a vertical earthen retort and heated to redness; then a stream of chlorine gas is passed through them. The chlorine combines with the alumina (being greatly helped by the charcoal), and forms chloride of aluminum, which unites with the sodium chloride (common salt), and distills over or sublimes as double chloride of aluminum and sodium, thus:

$$\underbrace{Al_2O_3}_{\text{Alumina.}} + \underbrace{2NaCl}_{\text{Common Salt.}} + \underbrace{3C}_{\text{Coke.}} + \underbrace{3Cl_2}_{\text{Chlorine.}} = \underbrace{3CO}_{\text{Carbonic Oxide Gas.}} + \underbrace{2AlNaCl_4}_{\text{Double Chloride of Aluminum and Sodium.}}$$

Ten parts of the double chloride of aluminum and sodium thus formed is mixed with five parts of kryolite (a double fluoride of aluminum and sodium, found in Greenland), which serve as a flux, both in a state of fine powder, and to this mixture is added two parts of (metallic) sodium in small pieces.

The whole is now introduced on to the hearth of a reverberatory furnace, previously heated to the required degree, when a violent reaction ensues. The dampers are then closed, and all parts of the furnace kept as close as possible, to prevent access of air. This causes the mass to completely fuse. When the action has subsided and the decomposition is completed the furnace is tapped and the metal and slag are run into suitable moulds. Most of the aluminum collects in the bottom of the mould. Above this are two layers of slag, the top layer being sodium chloride (common salt), the middle layer being less fusible than the top, and consisting chiefly of fluoride of aluminum, in which small globules of aluminum are mechanically held, which are recovered by pulverization and sifting of the slag.

The following equation will show the reaction that takes place in the above reduction. Thus:

$$\underbrace{AlNaCl_4}_{\text{Double Chloride of Aluminum and Sodium.}} + \underbrace{AlNaF_3}_{\text{Kryolite, or Cryolite.}} + \underbrace{6Na}_{\text{Sodium.}} = \underbrace{2Al}_{\text{Aluminum.}} + \underbrace{4NaCl}_{\text{Common Salt.}} + \underbrace{4NaF}_{\text{Fluoride of Aluminum.}}$$

There are other methods, but this, says Mr. G. W. Gray, in *Knowledge*, gives the purest metal, and is one generally used in England and France. Messrs. J. Lowthian Bell & Co. (or Messrs. Bell Bros.), at Washington, near Newcastle-on-Tyne, manufactured aluminum on a large scale for several years, but gave it up a few years since, owing to it not paying so well as was first anticipated, and also on account of the limited demand for the metal. I think they used the above method.

### Glucose from Cassava.

For some time past rumors have been current here of a company being in process of formation with a view of manufacturing glucose from cassava, but after careful inquiry, we have not been able to trace them to a reliable source. We have no hesitation, however, says the *Confectioners' Journal*, in saying that such a company is contemplated at an early day, and this fact adds interest to the plant which seems destined to take a prominent part in the development of the confectionery trade, and calls for more than a passing notice from us as to the nature of cassava, its *habitat* and its merits as a saccharine producing material. All confectioners know that glucose has become a very important article of commerce during the past few years, and the consumption of it has reached 200,000 tons in this country alone, and a large quantity is annually exported. It has been made heretofore from corn, which has advanced so much this year as to make this much-needed article quite expensive. The demand for it is very large and exceeds the supply. Heretofore the profits of manufacturing it have been very great at the rate paid for corn during the past few years. During the trial of a recent lawsuit in New York it came out in the evidence that the Buffalo Grape Sugar Company sold to one agency $100,000 worth of grape sugar, or glucose, per month. That company is now using nearly 6,000 bushels of corn every day in the week. A bushel of corn weighing fifty-six pounds will yield thirty pounds of sugar or glucose; the average net profit on a bushel of corn is between forty and fifty cents, since when the price has materially advanced. This would make the average profits of the Buffalo Grape Sugar Company over $1,000,000 a year, on a capital now invested of $4,000,000. The manufactured glucose is used chiefly for making table sirups, candies, for brewing purposes, as food for bees, and making artificial honey. It is estimated that 11,000,000 bushels of corn will be used this year by the various manufactories of this product in this country. The average production of corn in the States of Pennsylvania, New York, Ohio, Michigan, and Illinois is 35 bushels to the acre. The amount of glucose produced from one bushel is 30 pounds, or 1,050 pounds to the acre. Well authenticated evidence is at hand to the effect that 20 tons of cassava to the acre is no unusual crop in Florida. This would, at 56 pounds to the bushel, give a yield of over 700 bushels per acre, and, at the rate of 30 pounds of glucose per bushel, would produce over 21,000 pounds of glucose per acre. A comparison of the yield of glucose from corn and cassava from a large area is as follows: 1,000 acres of corn yields about 500 tons of glucose; 1,000 acres of cassava yields about 10,000 tons of glucose.

The method of cultivation is generally as follows: The ground is prepared as for planting corn, the seed (which consists of a section of the stalk containing an eye) is set in the sandy soil spaced about two feet, in rows three feet apart. When about eighteen inches high the field is cultivated in order to raise the soil about the base of the stalk, which affords a better support to the plant.

The leaves of the branching top shade the ground, and prevent the formation of weeds and evaporation of surface moisture. No irrigation is required, as the moisture is continually supplied to the tubers by capillary attraction. The tubers grow somewhat similar to the sweet potato, radiating from the base of the plant and lying generally horizontal. They may be utilized in about six months after planting, and will continue to grow without deterioration for a period of two years or upward, developing to such an extent that tubers weighing from sixty to eighty pounds have frequently been taken from the soil. The harvesting of the crop is very simple: The stalk is raised and tubers extracted by simply pulling them from the loose soil. The plant may be again inserted, when it will produce new roots. The earth in this case is the storehouse from which the supply is extracted as required, with the advantage of the crop increasing in value as long as it remains therein, whereas in corn there is a season for harvesting, storing, handling, and rehandling before it comes to the hands of the manufacturer.

Cassava may be removed from the ground any day in the 365, and carried to the mill for direct treatment. For many years the root has been raised in Florida and used for many purposes. The plants are natives of South America. The roots (tubers) may be preserved for food purposes, by being simply cleaned, sliced, and dried; from such dried slices manioc or cassava meal, used for cassava bread, etc., is prepared by simply grating. The starch is separated and prepared for food under the name of Brazilian arrow-root, and this, when agglomerated together into pellets on hot plates, forms the tapioca of commerce.

The glucose made from cassava is of fine body and flavor.

### NEW INVENTIONS.

An improved cuff or collar fastening has been patented by Mr. Mahlon Loomis, of Lynchburg, Va. This invention consists in a strip of metal bent at each end in opposite directions to form spring hooks, having the inner surfaces roughened or serrated and the curved portions corrugated.

An improved nose feed bag for animals has been patented by Mr. Charles J. Gustaveson, of Salt Lake City, Utah Ter. This nose bag has a supporter having two or more cross stays on the lower end for protecting the perforated bottom. The latter is made removable so that the device may be used as a muzzle.

An improved horse collar pad has been patented by Mr. Friderick F. Kanne, of Waterville, Minn. This improved pad can readily be applied to or removed from a collar; only the lugs of the arched frame rest on the horse's neck, and they are covered by a double thickness of leather. The pad will adapt itself to the neck of any horse, and the collar cannot become misplaced in its seat in the curved frame. There is an air chamber for the free circulation of air between the curved arched frame and the pad.

An improvement in end gates for wagons has been patented by Mr. Stephen D. Davis, of Malvern, Iowa. This invention relates to end gates for wagons, which are adapted to be let down to form boards or extensions to facilitate the use of a shovel in the removal of corn, potatoes, etc., with which the wagon may be loaded.

An improvement in that method of closing bottles and jars in which the stopper is made in two parts with holes through both parts that are closed by bringing these two parts together, has been patented by Mr. James D. Foster, of London, Ky. It consists in combining with the neck of a jar two circular disks of equal diameter having flat sides with holes through them, which holes are arranged out of registration, and one of which disks is forced down flat upon the other to close the holes in the same and form practically but a single stopper, and with which two disks is preferably combined a top coating of wax or cement.

Mr. Charles A. Kilpatrick, of Athens (Orcut Creek P. O.), Pa., has patented an improved adjustable instrument for planing and smoothing the edges of soles of boots and shoes. It consists in a handle with a bend or knee in the middle, and provided at this bend and on the under side with a curved knife and a gauge adjustable in the direction of the length of the handle. A sliding gauge, moving at right angles to the length of the handle, is held on the side of the same by a suitable screw.

An improved machine for spinning and reeling silk has been patented by Mr. Joseph E. Tynan, of Paterson, N. J. These improvements relate to machines for spinning and reeling silk. The usual process is to spin or twist two or more threads of unspun silk to form a single warp, which is afterward reeled into skeins by a separate machine. The object of the improvements is to perfect both the spinning and reeling mechanism, and further, to combine them in one machine, so that the operations can be successively performed without the time and labor required for spooling the silk after spinning.

An improved car coupling has been patented by Mr. Moses Robeson, of Galena, Kan. The object of this invention is to provide a car coupling by means of which two cars can be coupled together and uncoupled without running them together while the link is being adjusted, thereby avoiding danger to life and limb in coupling cars.

### A New Sleep-Producing Agent.

According to the *Medical Record* Professor C. Binz, in a series of articles contributed to the *Berliner Klinische Wochenschrift*, announces the discovery of nerve-depressing and sleep-producing properties in ozone.

The accepted view regarding this gas has been that it is very easily decomposed, nascent oxygen being set free; that it is extremely irritating on this account to the tissues, acting much like chlorine, and that it cannot be absorbed by the blood. Binz, however, shows that, in proper quantities, it is not irritating, can be inhaled and absorbed, producing, as he claims, peculiar effects on the nervous system.

The gas was generated by the sparks of an electrical battery containing four of Bunsen's elements. The ozonized air was conducted by a tube through chloride of calcium. It was then carried by a tube either to a large air-tight glass bell, in which an animal was placed, or to a mask which was worn by the persons who inhaled it. Animals were first tried. If a strong and long-continued dose of the ozone was supplied, the usual symptoms of laryngeal and tracheal catarrh with strangulation and death occurred. If supplied in more diluted quantities for less than two hours, sleep or a lethargic condition was produced. Frogs, rabbits, and kittens, reacted best. The latter would, in the course of ten or fifteen minutes, become quiet and then lie down and apparently sleep. Shaking the jar would not arouse them. When removed and supplied with fresh air, however, they soon returned to their normal condition. Several animals were killed after having been in this condition, and no changes in the air passages or other tissues noted. Precautions were taken and experiments made to show that there was no carbonic acid poisoning and no introduction of nitrous oxide gas. The animals could, as a rule, be kept in the bell-jar for two hours before any symptoms of irritation appeared, even of the outer parts of the air passages.

The experiments were then tried upon human beings. Dr. Hugo Schultz was the first to submit himself. Subsequently five other gentlemen inhaled the gas. Three of them were put to sleep by it, the others were slightly stupefied or otherwise depressed. The time required for bringing on sleep varied between six and sixteen minutes. The sensations during this time were very agreeable. After removal of the gas the sleeper would awake within half a minute, generally sooner. It was suggested that in one quite susceptible person the condition was a hypnotic one, but inhalation in the same way of pure air produced no effect. After awaking there was some feeling of fatigue, but this soon passed away.

Large and prolonged doses of the gas produced sensations of nausea, dizziness, and strangling. But the diluted ozone was breathed for over half an hour without harm. Binz states that in too small amounts no effect is gotten; in too large ones, irritation is produced. He compares its action in this respect to that of alcohol when given. Prof. Binz claims no practical results from his discovery as it stands at present, but thinks that like every new scientific truth it may have eventually some useful bearing,

### Coloring Metals.

Metallic objects may be colored by immersing them in a bath formed of 640 grains of lead acetate dissolved in 3,450 grains of water and warmed to from 38° to 90° Fah. This mixture gives a precipitate of lead in black flakes, and when the object is plunged into the bath the precipitate deposits on it. The color given depends on the thickness of the skin, and care should be taken to treat the object gradually, so as to get a uniform tint. Iron treated thus acquires a bluish aspect like steel; zinc, on the other hand, becomes brown. On using an equal quantity of sulphuric acid instead of lead acetate, and warming a little more than in the first case, common bronze may be colored red or green with a very durable skin. Imitations of marble are obtained by covering bronze objects, warmed to 100° Fah., with a solution of lead thickened with gum tragacanth, and afterward submitting them to the action of the above-mentioned precipitate of lead.

### Do Bees Injure Grapes?

At the late annual meeting of the Northeastern Beekeepers' Association, the charge that bees injure grapes was discussed with some feeling. Two bills have been introduced in the California Legislature to forbid the keeping of bees because of the damage they are said to do to the ripening grapes. The northeastern beekeepers were unanimous in the opinion that honey bees never puncture the skin of the grape, though they frequent the vines to suck the juices of grapes already injured by birds or other insects. This it was claimed has been demonstrated by careful tests. Black ants are the chief mischief makers.

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## Business and Personal.

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Peck's Patent Drop Press. See adv., page 94.

Supplement Catalogue.—Persons in pursuit of information on any special engineering, mechanical, or scientific subject, can have catalogue of contents of the SCIENTIFIC AMERICAN SUPPLEMENT sent to them free. The SUPPLEMENT contains lengthy articles embracing the whole range of engineering, mechanics, and physical science. Address Munn & Co., Publishers, New York.

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Lightning Screw Plates and Labor-saving Tools, p. 93.

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Cope & Maxwell M'f'g Co.'s Pump adv., page 108.

The Berryman Feed Water Heater and Purifier and Feed Pump. I. B. Davis' Patent. See illus. adv., p. 110.

See Bentel, Margedant & Co.'s adv., page 110.

Steam Hammers, Improved Hydraulic Jacks, and Tube Expanders. R. Dudgeon, 24 Columbia St., New York.

Telegraph, Telephone, Elec. Light Supplies. See p. 109.

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Eagle Anvils, 10 cents per pound. Fully warranted.

For Pat. Safety Elevators, Hoisting Engines, Friction Clutch Pulleys, Cut-off Coupling, see Frisbie's ad. p. 108.

Peerless Colors for Mortar. French, Richards & Co. 4 0 Callowhill St., Philadelphia, Pa.

Saw Mill Machinery. Stearns Mfg. Co. See p. 93.

Elevators, Freight and Passenger, Shafting, Pulleys and Hangers. L. S. Graves & Son, Rochester, N. Y.

Gould & Eberhardt's Machinists' Tools. See adv., p. 108.

Gear Wheels for Models (list free); Experimental Work, etc. D. Gilbert & Son, 212 Chester St., Phila., Pa.

Barrel, Key, Hogshead, Stave Mach'y. See adv. p. 110.

For Heavy Punches, etc., see illustrated advertisement of Hilles & Jones, on page 108.

The Medart Pat. Wrought Rim Pulley. See adv., p. 109.

Pays well on small investment.—Stereopticons, Magic Lanterns, and Views illustrating every subject for public exhibitions. Lanterns for colleges, Sunday schools, and home amusement. 116 page illustrated catalogue free. McAllister, Manufacturing Optician, 49 Nassau St., N. Y.

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Catechism of the Locomotive, 625 pages, 250 engravings. Most accurate, complete, and easily understood book on the Locomotive. Price $2.50. Send for catalogue of railroad books. The Railroad Gazette, 73 B'way, N.Y.

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The Porter-Allen High Speed Steam Engine. Southwork Foundry & Mach. Co., 430 Washington Ave., Phila. P.

Ore Breaker, Crusher, and Pulverizer. Smaller sizes run by horse power. See p. 109. Totten & Co., Pittsburg.

4 to 40 H. P. Steam Engines. See adv. p. 108.

## Notes & Queries

### HINTS TO CORRESPONDENTS.

No attention will be paid to communications unless accompanied with the full name and address of the writer.

Names and addresses of correspondents will not be given to inquirers.

We renew our request that correspondents, in referring to former answers or articles, will be kind enough to name the date of the paper and the page, or the number of the question.

Correspondents whose inquiries do not appear after a reasonable time should repeat them. If not then published, they may conclude that, for good reasons, the Editor declines them.

Persons desiring special information which is purely of a personal character, and not of general interest, should remit from $1 to $5, according to the subject, as we cannot be expected to spend time and labor to obtain such information without remuneration.

Any numbers of the SCIENTIFIC AMERICAN SUPPLEMENT referred to in these columns may be had at this office. Price 10 cents each.

Correspondents sending samples of minerals, etc., for examination, should be careful to distinctly mark or label their specimens so as to avoid error in their identification.

TO OUR CORRESPONDENTS.—The destruction of our old offices by fire January 31, 1882, caused the loss of a considerable number of inquiries from correspondents and of our replies thereto, which we had in hand for publication. Those of our friends who find their inquiries neglected will know from the above the reason why; and they will oblige the editor by repeating their inquiries without delay.

(1) E. M. F. asks: Can you give good receipts for making indelible aniline black inks, for use in marking linen with a pen? A. Dissolve 1 oz. of cupric chloride in 3½ oz. of distilled water, and add 1¼ oz. of common salt, and 1⅛ oz. aqua ammonia (C. P.). One volume of this solution is then mixed with four parts of a solution prepared as follows: Aniline hydrochlorate, 3¾ oz.; distilled water, 2½ oz.; gum arabic solution (gum 1 oz., water 2 oz.), 2½ oz.; glycerine, 1¼ oz. The greenish liquid resulting is an excellent indelible ink for linen, although the characters written with it do not develop a full black color until after exposure to the air for a day or two if not hot pressed. The following is Puscher's formula for a similar ink: Dissolve 4 parts of aniline black in 16 parts by weight of alcohol, with 60 drops of strong (pure) hydrochloric acid, and dilute the dark blue solution with 90 parts by weight of water in which 6 parts of gum arabic have been previously dissolved.

(2) M. S. asks: 1. Please give a receipt for preparing a good gold colored bronze for use on japanned work? A. Verdigris, 8 oz.; tin oxide (putty powder), 4 oz.; borax and niter, each 2 oz.; corrosive sublimate, ¼ oz.; make all into a thick paste with oil, and fuse together. 2. Can you tell us of a good way to reproduce faded photographs, faded paper prints? A. The following method is simple and in most cases quite effective: Put the card in warm water until the paper print may be removed from the card backing without injury. Hang up the paper in a warm place until perfectly dry, and then immerse it in a quantity of melted white wax. As soon as it has become thoroughly impregnated with the wax it is pressed under a hot iron to remove excess of the latter, and rubbed with a tuft of cotton. This operation deepens the contrasts of the picture and brings out many minor details previously invisible, the yellowish whites being rendered more transparent, while the half tones and shadows retain their brown opaque character. The picture thus prepared may then be used in preparing a negative which may be employed for printing in the usual way.

(3) E. W. F. asks: Can you give receipts for the dips used in imparting light fancy or vari-colored tints (or bronzes) on iron, zinc, copper, and brass? A. Dissolve 4 oz. hyposulphite of soda in 1½ pints water, and add a solution of 1 oz. lead acetate in 1½ pints of water. The metals to be colored are placed in this liquid, which is then gradually heated to the boiling point. This treatment produces on clean iron a light steel blue color, zinc becomes bronze, and copper or brass become successively red, scarlet, deep blue, light blue, bluish white, and finally white with a tinge of red. This dip has little effect on lead or tin. By replacing the acetate of lead in the solution by sulphate of copper, brass becomes first of a rosy tint, then green, and finally an iridescent brown color. Zinc does not color in this liquid; it reduces and precipitates the copper as a dark brown sponge, but if boiled in a dip containing both the lead and copper salts, it becomes covered with a black adherent crust, which may be improved by coating with a thin wax lacquer. Sometimes these liquids are thickened with gum tragacanth and applied to the plates with a brush to form designs, etc., and the plates are then heated to 212° Fah., and rinsed or plunged into one of the hot baths, by which a variety of effects are produced.

(4) I. M. McP. asks for a receipt for coating wood to make blackboards for school purposes, etc. A. To make one gallon of the paint take 10 oz. of pulverized and sifted pumice stone, 6 oz. powdered rotten stone (or infusorial silica), ¾ lb. of good lampblack, and alcohol enough to form with these a thick paste, which must be well rubbed and ground together. Then dissolve 14 oz. of shellac in the remainder of the gallon of alcohol, by digestion and agitation, and finally mix this varnish and the paste together. It is applied to the board with a brush, care being taken to keep the paint well stirred so that the pumice stone will not settle. Two coats are usually necessary. The first should be allowed to dry thoroughly before the second is put on. The second coat should be applied so as not to disturb or rub off any portion of the first. One gallon of this paint will ordinarily furnish two coats for sixty square yards of blackboard. When the paint is to be put on plastered walls the wall should be previously coated with glue size—glue, 1 lb.; water, 1 gallon; lampblack q. s. to color; put on hot.

(5) B. W. S. writes: I wish to draw water from a sixteen foot head, through hydrant, the connection between the two being 1¼ inches—lead pipe of the kind known as "extra light." Will this pipe stand the pressure without fear of bursting? A. Your pipe would stand the pressure of 16 feet head, but probably would not stand in connection with a hydrant, when the current will be started and stopped many times a day, and subjecting the pipe to shocks or "water hammer." If the pipe is to be thus used we would advise a stronger one.

(6) J. T. asks: 1. Does a glass water gauge sustain full boiler pressure? If so, why does it not burst? A. Yes. It does not burst because the tube is small and thick. 2. Is there any difference in efficiency between one gallon of water raised to 100 pounds steam and 100 gallons raised to same pressure? A. Under the same conditions the work should be nearly in proportion to the water evaporated.

(7) H. M. asks: 1. How high will 50 pounds pressure to the inch in a force pump throw water from a quarter inch nozzle? A. A quarter inch nozzle, about 44 feet. 2. Or what size stream from nozzle under 50 pounds pressure reaches the highest? A. The larger the stream the higher the jet, if the pressure be maintained. If the nozzle were three-quarters inch the height would be about double that from a quarter inch nozzle.

(8) E. F. T. would like to know if it is necessary for a steam pump to have a vacuum chamber to lift water at any distance? If not, will you please explain? A. It is not necessary. The air chamber is put on to prevent shocks or "water hammer" in the suction pipe.

(9) M. S. asks: 1. Would it be safe to run our 18x36 inch engine 80 revolutions per minute—fly wheel 14 feet diameter, 6 tons weight; engine is now running 70 revolutions? How much more power would we get: steam 90 pounds, 5 inch steam pipe, 6 inch exhaust? A. Yes; if well proportioned and balanced. With same pressure of steam the increase of power is in proportion to revolutions.

(10) D. D. D. asks: 1. What is the proper proportion and area of steam and exhaust ports for a 2 inch by 4 inch steam cylinder, 80 pounds steam, boiler pressure 200 revolutions per minute? A. Steam ports one-tenth area of piston, exhaust one-sixth to one-seventh area of piston. 2. What area steam pipes and exhaust pipes should have to area of cylinder? A. Refer to rule in SUPPLEMENT No. 253.

(11) D. F. H. asks: What kind of barometers are used by the Signal Corps, U. S. A.? A. Both mercurial and aneroid.

(12) J. K. & S. write: The length of my drain is 165 feet, total fall is 8 32 feet; the question we wish answered is this: our creek is often full from bank to bank, and we want to know if the water escaping from, say, a half inch pipe, with a pressure of 100 pounds to the inch, will flow away through a 4 inch sewer pipe with fall of 8 32 feet when creek is full? The fall to top of bank, or when our creek is high, is 4·25 feet: will the high water retard the flow enough so that the 4 inch pipe will not take it away fast enough? We are compelled to put in our water motor on first floor, and we do not want to put in motor unless we can get the waste water as it flows from a Tuerk's water motor fast enough so as not to inconvenience us or overflow. A. Yes; your 4 inch drain will carry off the water with 4·25 feet fall in 165 feet.

(13) H. S. N. asks: What cause or causes might produce a collapse of a flue in a steam boiler? A. The flue not being a true cylinder, or different thicknesses of iron used in the different parts of the flue might cause it. Flues as usually made are not perfectly true cylinders, therefore extreme pressure will produce collapse.

(14) W. F. L. writes: 1. I have charge of a locomotive engine, cylinder 8x16. The boiler is too small to generate sufficient steam to pull the load at the speed desired. The cylinders have two inches clearance at each end. Can I fill a portion of this space by attaching pieces to cylinder heads, say 1 inch or 1½ inches thick, and thus save steam? A. Yes. 2. One of the steam chests has a hole in it where the stuffing box joins the chest, three-sixteenths by half an inch in size on outside, but larger on the inside. Can I fill it with the material of which rust joints are made (salammoniac and iron borings), and make a durable job? A. No. Can you not drill out the hole and put in a top screw or bolt?

(15) H. E. writes: I would like to ask you if common wrought iron will do for the magnets in an electric bell, and what size wire is used? A. Common iron will do if well annealed. Use No. 22 wire.

(16) W. A. P. asks: 1. Can you give me a scheme for making volumetric estimations of silica or silicates in lead and iron ores? None of the works at hand give any information on this subject. A. We know of no good practical way of determining silica by the volumetric method. Silica is usually estimated gravimetrically. Consult Thorp's "Quantitative Chemical Analysis." 2. I am using charcoal fuel and a common water jacket furnace. What are the reactions, and why is limestone used in the following charges: Ore—lead sulphide, 2 per cent; arsenic, 1 per cent; zinc lead, 74 per cent; silica, 5 per cent; charge—ore 100 lb.; limestone, 24 lb.; iron ore (perox ide, 62 per cent iron, 3 per cent silica), 68 lb.; charcoal, 40 lb.? A. Lime (or limestone which becomes lime in the furnace) is an alkaline flux combining with and rendering fluid the silicates and silicious earths contained in the ore and fuel, thus releasing the metallic burden and aiding the reduction by the iron and carbonic oxide. According to the analysis given the lime charge in this case seems to be considerably in excess of the requirements.

(17) W. S. asks: Can you tell me the way to make scagliola, an imitation of marble? A. See answer to M. N., next page.

(18) P. D. asks: 1. What does gas tar owe its preserving qualities to? A. Chiefly to the presence in it of small quantities of carbolic acid or phenol, creosote, and similar substances. 2. What late elementary works on chemistry do you recommend? A. Consult Fownes' "Elements of Chemistry," Barker's "Text Book of Chemistry," Youman's "Class Book of Chemistry," Cooke's "New Chemistry." Address the book dealers who advertise in this paper.

(19) J. H. & Son ask: How can we remove from ordinary rubber tubing its objectionable smell? A. Boil the tubing for a few minutes in water containing about 5 per cent of caustic potash, rinse well in hot water, and then immerse for about half an hour in cold water containing 3 per cent of hydrochloric acid. Finally rinse thoroughly in running water.

(20) G. H. asks: What can be used in mortar to prevent it freezing in cold weather? Salt does not appear to "fill the bill." Will the substance called chymogene (about which I know nothing) do this? A. We know of no practical substitute for salt in this connection. Glycerine would prevent the freezing if used in sufficient quantity, but it would be apt to greatly retard the setting. Chymogene is a very light distillate of petroleum, and could not be used in mortar as proposed.

(21) E. J. E. writes: 1. I wish to silver the outside of a lot of lamp globes, so as to make mirrors of them. Can you tell me how silvering on such glass surfaces is done? A. You will find explicit directions for silvering glass in SUPPLEMENT, No. 252. 2. Cannot the electric light be produced from a galvanic battery? If so, why are dynamo machines used? A. A battery can be used for purposes of electric lighting, but it is vastly more expensive to maintain than the dynamo, and does not afford as constant a current.

(22) H. P. asks: Can you tell me how sulphur can be deodorized? A. The characteristic odor of sulphur developed by heat cannot be removed.

(23) H. L. K. asks: Can you give me a receipt for the preparation of a cement or paste to unite leather and paper to iron? A. See receipts for marine glue, and other cements, page 2510, SUPPLEMENT No. 158.

(24) E. H. R. asks: 1. Can you tell me of an expeditious and efficient way to clean the inside of the barrels of a breech-loading shot gun? A. If the piece is quite dirty use a small cylindrical brass wire scratch brush (obtainable in the market), then apply a little oil and fine emery with a rag and steel or wooden rod, wiping out occasionally with a clean slightly oiled rag. Finally remove as much of the oil as possible with a clean dry rag. 2. What is the best way to remove rust and prevent its formation on such a piece? A. To remove the rust (if the metal has not been badly eaten into) rub the parts well with emery flour and good sperm oil on a cloth or chamois leather. The use of acids cannot be recommended. To prevent rusting clean the piece thoroughly, warm it, rub over every part pure refined sperm oil, then wipe as clean as possible with a dry cloth, and keep dry. 3. Will coal oil injuriously affect the barrels of such a gun? A. Not if the piece is well wiped afterward.

(25) E. N. H. asks: 1. What is a good waterproof varnish for brass models, something that will dry quickly? A. Try the following: Shellac, 3 oz.; alcohol, 1 pint; dissolve by digestion and agitation in a covered vessel, and dilute with alcohol if not thin enough for use. Warm the metal and apply the varnish quickly. 2. What would you recommend to clean fine mathematical instruments? A. The unlacquered parts may be brightened by rubbing them with a piece of chamois leather and jeweler's rouge; the lacquered parts (sometimes) by using the skin with a very little warm alcohol. When lacquered brass or iron work has become badly discolored it is usually necessary to remove all the remaining lacquer by hot potash water or alcohol; clean the surface of the metal, and relacquer it.

(26) R. E. R. writes: The beams under the floor of my room (second story) are 3 inches by 8 inches, and are 16 inches apart and about 18 feet long. I desire to place a lathe in the middle of the floor (standing lengthway with the beams), which, with appurtenances, will weigh about 700 pounds. Will the floor sustain such weight easily? How much will it sustain? Will the vibration caused by the treadle motion make any difference as to the safety? A. Yes; the floor will carry it if there is not much other load, but will be likely to vibrate or shake very much under the action of the treadle. Your girders should be not less than 12 or 14 inches deep.

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(27) G. W. I. writes: Please state the difference of draught of two cars of same dimensions and weight, one running on a two foot gauge track and the other on a four foot gauge? A. On four foot gauge—as the running gear will be heavier and the friction greater—with same size of wheels.

(28) W. P. T. writes: We have four boilers, 20 feet long and 48 inches in diameter, set in a battery with steam drum, carrying 80 pounds steam. We have two engines coupled together on one shaft and supplied with one steam pipe and one governor. The steam pipe branches, after passing the governor, one branch running to each engine of course. The engine cylinders are each 16 inches in diameter and have 20 inch stroke of piston. The governor is the same distance from each engine, *i. e.*, 3 feet, but is 53 feet from the governor to the steam drum, with two square turns between the governor and steam drum. The engines have common slide valves, and run 160 revolutions per minute. The steam feed pipe is 5 inches in diameter and governor is a 5 inch one, made by Allen Governor Company. Now the question is: Is the feed pipe large enough to supply the engines fully in hard labor, or do we lose power in putting the steam through so small a steam pipe? And how large should the steam pipe be to get the best result? A. If you use a cut-off on your engines, the pipe is large enough. If you work whole stroke, it would be necessary to apply an indicator to determine whether the pipe is too small. Your loss of power, if any, must be small.

(29) J. H. R. asks (1) how far apart steam pipes 2¼ inches in diameter should be from outside to outside in order to obtain the best results from the fire (soft coal). A. You do not state whether the fire is outside or inside the tubes. If outside, they can be placed at such a distance as necessary for draught, and this will depend upon arrangement of flues. If inside, not less than ¾ inch, and would be better if ⅞ or 1 inch. 2. How much higher should the end of a twelve foot pipe be at one end than at the other to allow the steam to escape freely? A. A rise of one inch to the foot will answer well. But more would be better if there is intense fire. 3. At which end of the pipes should the fire be placed, the highest or the lower end, to get the best effect of the fire? A. Lowest end. 4. What is the greatest pressure it would be safe to carry steam in lap-welded boiler tubes, 2½ inches outside diameter, tube weighing 2¾ pounds to the foot? A. 200 to 250 pounds per square inch. 5. How many pounds is about the greatest strain threads will bear in Seller's system of screw threads and nuts? A. The strength of the thread is intended to equal that of the bolt, if the nut fits well and is equal in thickness to the diameter of the bolt.

(30) J. C. L. asks: Do you know of any material or substance that is perfectly transparent (similar to glass) yet impervious or so reflective of the sun's rays as to prevent its usual fading effect on a delicate alkaline color? A. We know of no such substance.

(31) C. J. asks: Which would afford the greatest amount of power at the same pressure of steam, say 60 lb. to square inch, two engines, 3½ by 8 inch stroke, both connected to one shaft, or one engine 7 by 8 inch, to work from same shaft? What would be the difference in the power and also in fuel? The boiler is 54 inches long by 32 inches diameter; 34 two inch tubes; locomotive type. A. The 7 inch cylinder by 8 inch stroke would give double the power (with same pressure and speed) that would be given by two cylinders 3½ by 8 inch stroke, and with slightly greater economy of fuel.

(32) J. L. writes: I should like a receipt for a cement that will do for kerosene lamps. Can you give me a receipt through your columns? I have tried plaster of Paris and various other things, but without success. A. Plaster of Paris made into a paste with a sirupy solution (aqueous) of water glass, and used immediately, makes a very good cement for this purpose. Hot soft soap is used in connection with plaster in a similar manner for this purpose. See "Cements," page 2510, SUPPLEMENT No. 158.

(33) W. G. B. asks: Will you kindly tell me how to make the common liquid ammonia and alcohol of commerce; also camphor in small quantities? A. Dissolve about 10 pounds of sugar in 5 gallons of water; add a little yeast, and set aside in an open vessel in a cool place to ferment. As soon as the fermentation subsides put the liquid in a retort and apply heat. When the liquid begins to boil attach a coil of small copper pipe so as to receive the steam or vapor, and immerse this coil in a tub of cold water so that the vapors will be condensed within it, and drip out the lower end into a receiver. The spirit thus obtained will contain much alcohol. It is rectified by careful redistillation, and called alcohol. To make liquid ammonia mix 10 pounds powdered sal-ammoniac with about 6 pounds pure lime (previously dry slaked); put this mixture into an iron retort, and apply a moderate heat. Pass the ammonia gas given off through a series of bottles half filled with cold water; the water will absorb the gas, and when enough of the gas has thus been absorbed the water in the bottles becomes aqua ammonia (ammonia water). Consult Wagner's "Chemical Technology" and the United States Pharmacopœia.

(34) C. H. B. asks: What can be used as a substitute for glycerine in printer's rollers besides sugar or molasses? A. We know of nothing that could be used with advantage as a substitute for these in this connection.

(35) H. A. L. asks: 1. How shall I go to work to make an electric light? A. See "Simple Electric Light Apparatus," in SUPPLEMENT, No. 159. 2. What chemical will soften silver enough to join two pieces together? A. We know of no chemical that will soften silver so that it may be joined. Silver solder is usually employed for joining pieces of the metal. 3. Will common sweet oil do in place of olive oil for that phosphoric oil as described in No. 318? A. Yes.

(36) C. A. C. writes: On page 208 of *Science Record* for 1875 is a description of a new artificial light. I have been to considerable expense in making it, but I can only get a very dim light, and the smoke is very hard to get rid of, there being so much of it. I used oil of vitriol, supposing it to be sulphuric acid. Will you please advise me as to what the trouble is, and how I can improve the light? A. The apparatus referred to is not designed to produce a very brilliant light. The faint blue flame, however, possesses sufficient actinic power to make it, in some cases, serviceable for photographic purposes. A glass chimney can be made to confine and conduct the smoke to a flue. The greater portion of the products of combustion are readily absorbable in moist slaked lime. Common sulphuric acid is commercially known as oil of vitriol.

(37) M. N. writes: I want to make a large slab of artificial marble. Can you inform me of a composition for such which will become as hard and strong as marble itself? A. Try the following: Reduce marble dust or white limestone to a very fine powder by grinding and sifting, mix with it intimately about one-fourth its weight of zinc oxide (zinc white) and one-eighth its weight of Portland cement, and mix thoroughly into a thick paste with a sufficient quantity of a hot aqueous solution of water-glass, containing about 40 per cent of the glass. Mould the paste under pressure while warm, and expose the moulded form for a week or ten days to warm dry air, before finishing. See "Water-glass," page 16, vol. xlv.

(38) J. A. H. asks: 1. Can soapstone ground fine be moulded into different shapes by mixing with some ingredient, and hardened for bricking or ornamental purposes, such as mantels, table tops, etc.? A. Soapstone powder mixed with water-glass (see SUPPLEMENT No. 317) can be moulded when moist into various forms, which, when dried, become quite hard and closely resemble the natural stone. This artificial stone does not, however, stand heat as well as the native rock. 2. From what quarries do the New York dealers procure their soapstone? A. Chiefly from Vermont and the Carolinas. For the other information you should address some dealer in soapstone. 3. Will the quarry widen as you go down? A. We have no means of judging—probably not.

(39) D. J. C. asks: Will you please state what are the proper ingredients and proportions and how to mix and apply them to brick work, to stain the latter to represent red brick? A. The color is clear red ocher or Indian red, and the vehicle a thirty-five or forty per cent aqueous solution of good soda water glass (see SUPPLEMENT, No. 317). The pigment and vehicle must be well ground together. It is preferably used hot.

(40) R. E. N. asks: How can I make oxygen to use with the appliance described in SUPPLEMENT No. 20, 1876, under the head of "Soldering," by George M. Hopkins? A. See page 5013, SUPPLEMENT, No. 314.

(41) D. L. asks: Will you kindly give me a receipt for making printer's composition rollers for power cylinder presses? A. An equal quantity of concentrated glycerine and good glue are weighed out; the glue is softened by soaking it over night in a little cold water, and then dissolved in the glycerine by aid of heat over a waterbath. The heating is continued for several hours to expel the water taken up by the glue in softening, and then poured into the oiled metal moulds. A small quantity resin soap is added to the composition by some makers, and sometimes part of the glycerine is substituted by molasses.

MINERALS, ETC.—Specimens have been received from the following correspondents, and examined, with the results stated:

A. A. St. J.—We cannot undertake to analyze the substance—it is a complex mixture of drugs and organic substances.—M. B.—The crystals are calcite—lime carbonate; the rock is dolorite trap.—F. F. & W. F.—1. Barium sulphate or heavy spar—used to some extent by paint manufacturers. 2. An impure quartzose sand containing films of mica and a small quantity of iron sulphide—of no value.—T. B. H.—The liquid will require an analysis. We cannot tell what it is composed of by an examination.—A. E. A.—It appears to be chiefly composed of cork dust, chalk, plaster of Paris, water glass, and cologne spirits.

## NEW BOOKS AND PUBLICATIONS.

THE FOOD OF THE JAPANESE PEOPLE. By Thomas B. Van Buren, U. S. Consul General of Japan. Yokohama. 1881.

Among the many reports returned to the State Department at Washington by our consular agents abroad, this report on the food of the Japanese people is of exceptional interest. The subject has been investigated with a thoroughness which makes the report a scientific monograph of no mean order; and the subject itself has especial interest in its bearing on the question how far the characteristics of national life are determined by a people's food. It has happened that most if not all of the more forceful and active nations of the west have been large consumers of meat. So markedly has this been the case that it is commonly accepted as a truth practically demonstrated that a well fed, capable, progressive people must of necessity consume a large proportion of animal food. It gives this theory something of a set-back to learn that the most progressive of oriental nations, the Yankees of the East, as they have been called, are almost exclusively eaters of vegetable food. The masses do not eat meat simply because they cannot afford to eat it. Beef cattle are scarce, and mutton and pork still scarcer. Domestic poultry and wild fowl are so costly that even the well-to-do partake of them sparingly and only on special occasions. Fish are comparatively plentiful and are more largely eaten; so that it is estimated that half the people eat fish every day; one-quarter two or three times a week; the rest perhaps once or twice a month. Nevertheless the food of the masses is nine parts out of ten vegetable. Yet the Japanese are well fed, and though of small stature, are well developed physically, and capable of sustaining severe and long-continued mental and bodily labor. Their physical and intellectual superiority to the rice-eating Bengalese—so far as determined by the nature of their food—may perhaps be attributed in large measure to the prominent place given to highly nitrogenous plants of the class known as leguminous. More than forty varieties of peas and beans are cultivated. The richly nutritive soy bean properly supplements the rice, which plays so large a part in the national diet. After rice the cereals most cultivated are in order—barley, millet, wheat, rye, and Indian corn. The sweet potato takes the first place among tubers, the annual product being sixteen million bushels. This crop is rivaled by that of the large white and highly odorous radish known as "daikou." Carrots, turnips, parsnips, and the like are very largely eaten. The entire list of food plants covers a dozen long columns. Most of them have no western equivalents, though many of them no doubt might be profitably introduced among us. The manner of preparing a number of the leading articles is given according to the practice of the chief cook of a native eating establishment. The value of the copy of the report transmitted to us by Mr. Van Buren has been greatly augmented by extension. It has been interleaved with numerous photographic illustrations of Japanese life, which give one, so to speak, an inside view of the industrial and social life of the agricultural peasantry, the artisan classes, the merchants, doctors, teachers, professional storytellers, and the rest. Among the characteristic features of these views of the Japanese at home, in the field, journeying or pleasure taking, one cannot but notice the general expression of good humor upon the faces of the men, however ugly they may seem to our western eyes; the amiability, sometimes real beauty, of the women folk; and the comfortable open-eyed serenity of the babies.

THE UNIVERSAL CALCULATOR, WITH DIRECTIONS FOR USING IT. By W. H. Wythe. Red Bank, N. J.

A very simple and ingenious application of the principle of the slide rule to a circular chart of several scales with two movable arms. One arm is fixed to a central disk, against which the other arm bears with friction enough to cause it to be retained in any desired position relative to the first arm, while both arms are moved together around the concentric scales. By simple and obvious applications of the rules of proportion all arithmetical problems involving multiplication, division, even powers and roots, percentages, and so on—in short the vast majority of the problems that come before the artisan or the business man, can be quickly solved by an easy mechanical process. Any one who has much figuring to do would be likely to find it a very helpful time and labor saving instrument.

CAWKER'S AMERICAN FLOUR MILL DIRECTORY FOR 1882. Milwaukee. Wis.

The intelligence and care with which Mr. Cawker's work is done was attested in the directory of flour mill owners prepared by him last year. This edition he considers an improvement on the last. It gives the names and post office addresses of all the flour mill owners in the United States and Canada. The total number of addresses approaches twenty-three thousand.

THE USE OF TOBACCO. By J. I. D. Hinds, Ph.D. Lebanon, Tenn. Private print. 16mo, cloth, pp. 38.

An exceptionally temperate discussion of the tobacco habit, historically, commercially, physiologically, and socially considered. The tone of the argument against the use of tobacco is calm, and more than usually cogent in that it avoids extravagant assertion and rant. It is a good book to put into the hands of youth.

[OFFICIAL.]

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FOR WHICH

**Letters Patent of the United States were Granted in the Week Ending**

**January 31, 1882,**

**AND EACH BEARING THAT DATE.**

[Those marked (r) are reissued patents.]

A printed copy of the specification and drawing of any patent in the annexed list, also of any patent issued since 1866, will be furnished from this office for 25 cents. In ordering please state the number and date of the patent desired and remit to Munn & Co., 261 Broadway, corner of Warren Street, New York city. We also furnish copies of patents granted prior to 1866; but at increased cost, as the specifications not being printed, must be copied by hand.

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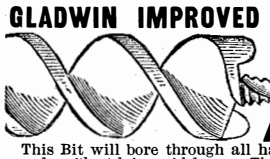

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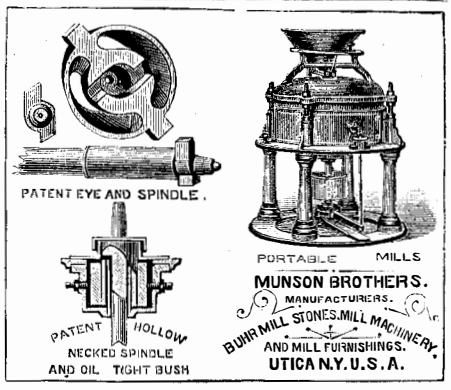
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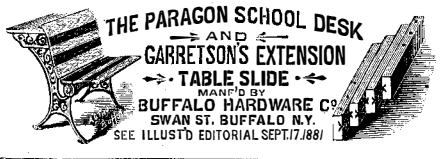


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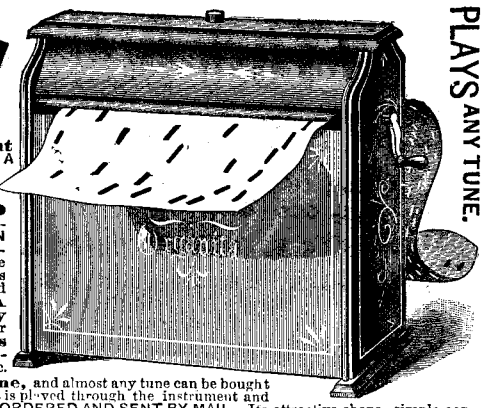


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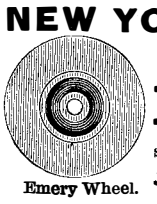
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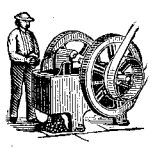

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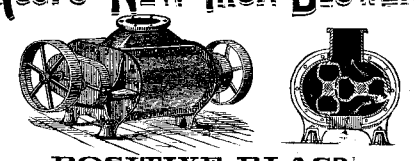

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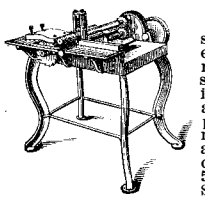

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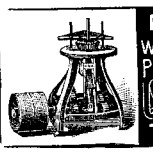

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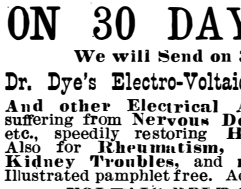

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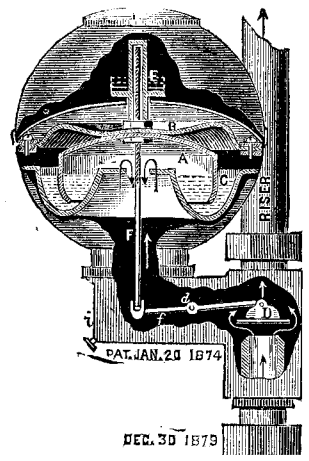


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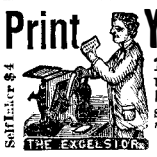


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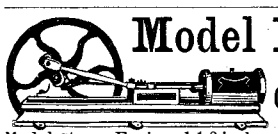

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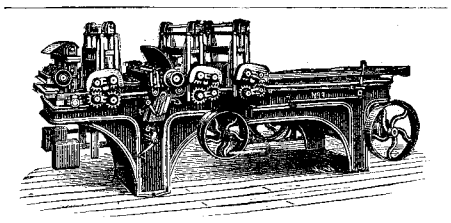

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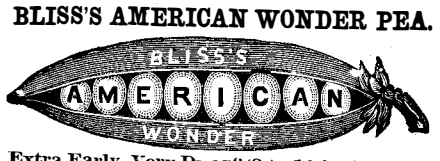


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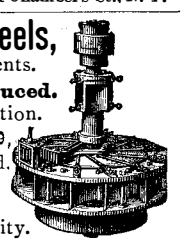

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